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World's newest fuel level switch

It's small (fountain pen size), it works on a new principle (semi-conducting solids), it's important—and it's called the Honeywell Thermistor Level Switch.

On the B-47, backbone of our strategic air force, this new Honeywell development is playing an important role. Acting as a high level switch in the Boeing Stratojet's fuel tanks, it prevents spillage at refueling time. Whether in the air or on the ground, spillage is wasteful and extremely hazardous.

Potentially, the Thermistor Level Switch has other important uses, too. As a low level switch it can automatically sequence fuel, act as a safety switch to protect fuel pumps and operate a low-fuel warning light.

The Thermistor Level Switch has no moving parts and is, therefore, far less subject to mechanical failures. Sloshing doesn't affect it, it's simpler to install and it has a longer, more dependable and reliable life than previously available switches.

It is available as a separate component or an integral part of a fuel measurement system.

The Thermistor Level Switch is the latest of many new Honeywell developments in the field of aviation controls. There'll be more, because automatic control is so important to aviation's progress. And automatic control is Honeywell's business.

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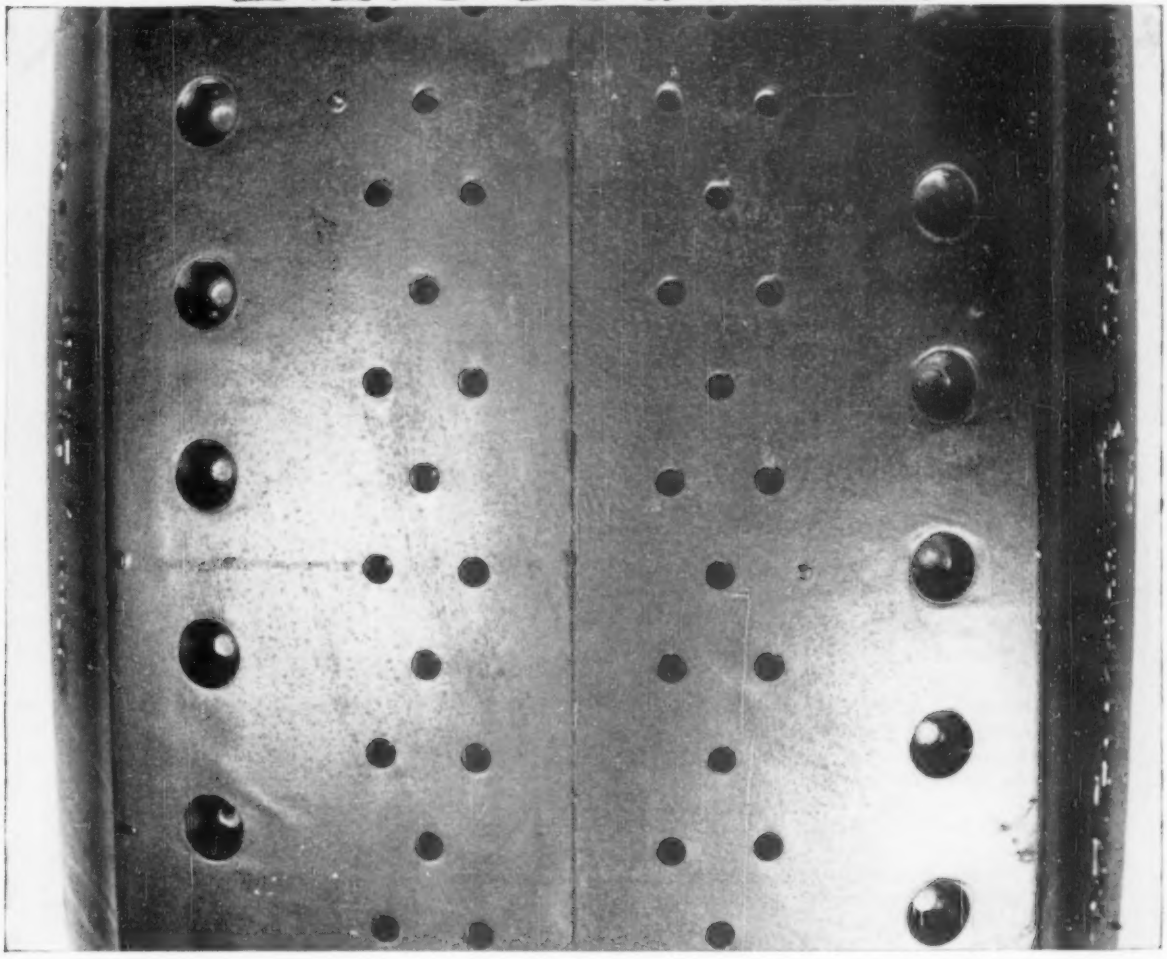

New tire puts more rubber to work to give even more landings

STARTING IN 1948, airline after airline put the B. F. Goodrich Dimpled Tire through the most extensive comparison tests. And it outwore all others—sometimes by as much as 27%.

Within 5 years, it was adopted by 24 airlines. The reason: dimple-like indentations resulted in better load distribution throughout a larger tread area. Wear was slower and more even with greater protection against tread cutting. It all added up to more landings before recapping.

Latest development in B. F. Goodrich Dimpled Tires is shown above. It is giving even more landings because it puts even more rubber to work. Dimples are sized, spaced and arranged to give an improved wear pattern. The tread is flatter to give a broader footprint the instant the tire touches the runway. Thus, wear is spread more evenly from shoulder to shoulder. In addition, the tread is made from new, longer-lasting rubber compounds.

Preliminary reports from current airline tests indicate the new B. F. Goodrich Dimpled Tire gives substantially more landings than any other kind of tire.

Although production of this BFG Dimpled Tire is still limited, it will soon be available in most popular sizes.

The new B. F. Goodrich Dimpled Tire is one of many "firsts" in aviation tires from B. F. Goodrich, leader in rubber research and engineering.

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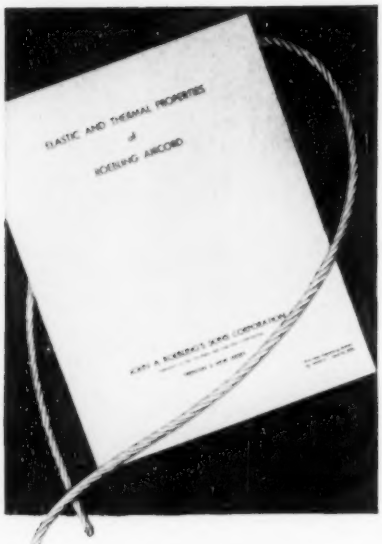

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THERMAL

properties of

AIRCORD

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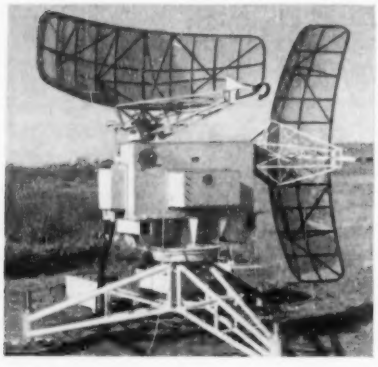

New, low-cost GCA system solves one of aviation's greatest problems!

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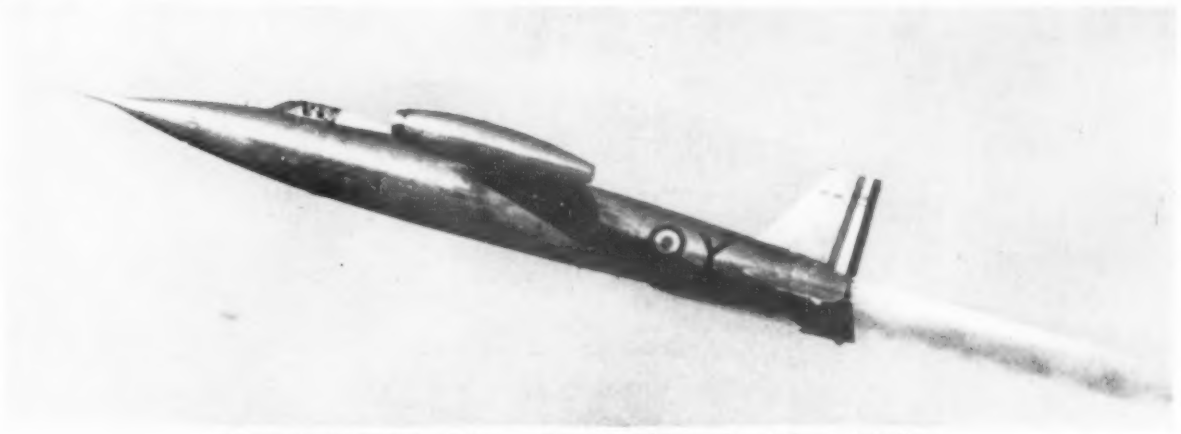

French Rocket Plane Paves Way for New Fighter

Performance data obtained from tests of this Sncaso S.O.9000 Trident, combination rocket/turbojet-powered research plane, have been used in designing a new interceptor now under construction by the French firm. S.O.9000 has two 880-lb.-thrust Turbomeca Marbare jets at the wingtips for takeoff, cruise and landing; the SEPR rocket in the tail, shown ignited, is for highspeed climb.

Robert Murray Quits Undersecretary Post

Robert B. Murray, Jr., Undersecretary of Commerce for Transportation and a controversial figure in air transport circles during much of his term in office, has resigned effective Jan. 20. President Eisenhower has accepted his resignation with "reluctance."

Murray came to the Commerce Department from Pennsylvania Economy League Jan. 28, 1953. He told the President he was returning to the business world "for personal reasons."

During his two years in the Commerce Department, Murray has sponsored several transportation studies, principal one being the air policy report produced by the Air Coordinating Committee, which he heads. The report set up federal policies in a wide range of aviation fields and has been a continuing source of controversy.

In a speech made the day the President accepted his resignation, Murray defended the air policy report, saying some groups have been "waving this 'chosen instrument' flag" hoping to mislead the public on what is actually contained in the report. He said the report does not revive the chosen instrument issue.

Domestic

Convair F2Y Sea Dart still requires "considerable work" before it can be ordered into production, says Assistant Navy Secretary for Air James H. Smith, Jr. First hydroski-equipped jet Sea Dart disintegrated in air during a demonstration flight on the West Coast last month (AVIATION WEEK Nov. 15, p. 20).

Fairchild Engine & Airplane Corp. has appropriated more than $1 million for accelerated research on boundary layer control applications to transport planes. One phase of the program will follow tests of a C-123 Avitruc fitted with Fairchild J44 turbojets at the wingtips, expected to fly in 30 days.

First contract for automatic production (Project Tinkertoy) of several thousand electronic subassemblies for sonobuoys has been completed successfully, Navy reports. Field tests of the mechanical assembled equipment indicate higher performance and reliability, Navy says, than equipment produced by conventional methods.

First Convair C-131B electronic "flying lab" to be used by the Air Force on special projects or assigned to firms for equipment development made its initial flight Dec. 1.

Northeast Airlines DC-3 crashed Nov. 30 on Mt. Success, about 10 mi. east of Berlin, N. H., while making an approach to Berlin Airport in a snow squall. Two NEA personnel were killed. Five survived, including the pilot and stewardess.

Air Materiel Command contract for a prototype simulator for the Cessna T-37A jet trainer has been awarded Link Aviation, Inc., Binghamton, N. Y. Due to be delivered in latter part of 1955, trainer will incorporate actual cockpit motion and have provision for seating the instructor with the pupil.

Maj. Gen. Merrill D. Burnside has replaced Maj. Gen. Carl A. Brandt as director of maintenance engineering at Air Materiel Command Headquarters.

Lynn K. Chapman, technical assistant to the communications branch chief of Air Materiel Command's Directorate of Maintenance Engineering, died at Dayton last month.

Financial

Grumman Aircraft Engineering Corp., Bethpage, N. Y., in the first nine-months report ever issued by the firm, reports net income of $7,175,677 for the period ending Sept. 30. Sales totaled $155,644,268.

International

Russia has invited Scandinavian Airlines System to fly into Berlin, operating from the Red airport in the Eastern Zone. SAS has turned down the offer, although it is interested in obtaining permission to fly into West Berlin.

Compagnie Air-Laos transport, carrying 26 passengers and crew of three, crashed near Luang Parbang, Laos, while making the first commercial flight from Vientiane to Muong Sing. Early reports indicated all aboard were killed.

J. G. M. Pardoe has been named deputy chief technical officer of the British Air Registration Board—first such appointment. Pardoe has been a member of the British delegations to Airworthiness Division meetings of International Civil Aviation Organization.

Uneven driving forces during rivet installation can crack skin panels. Rework is costly.

Using regular HI-SHEAR pins and collars, a countersunk strip can be added to seat the collar. This adds another part and weight.

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Now, your structure design can be more effective by using the new HI-SHEAR collar—countersunk and flanged—to match the sub-dimple and obtain HI-SHEAR advantages of reduced weight, space and time.

The HS53 2 4ST collar is used with alloy steel HI-SHEAR pins, i.e. HS51P; the HS54 A17ST collar accommodates the HS25 75ST pin.

Standard HI-SHEAR Sets form the collar to the pin with less force than required to upset DD icebox rivets – thus avoiding skin cracks.

write

for specification data on the HS53 and HS54 collars.

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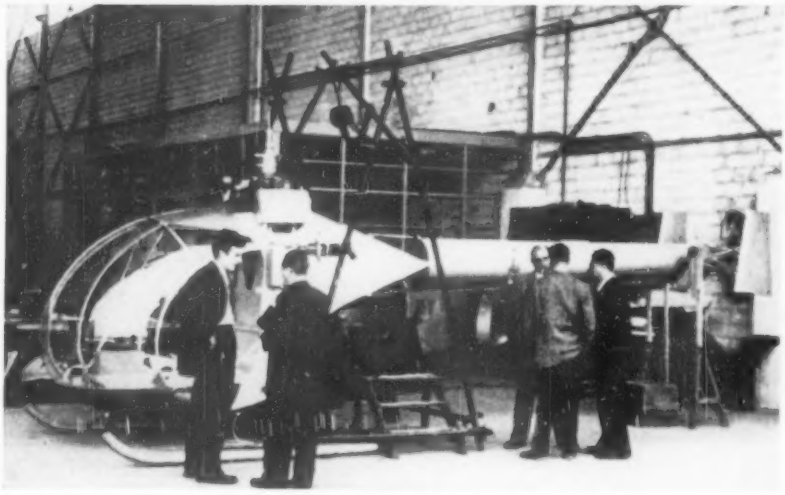
Small Aircraft Make Debuts



SPANISH Aerotecnica AC-13 (right) is one of several models being built. Rotor diameter is about 29.5 ft.

U. S. sportplane (below) is prewar Ryan ST-3KR revamped by Gene Sherry, Wisconsin. It has 220-hp. Continental.

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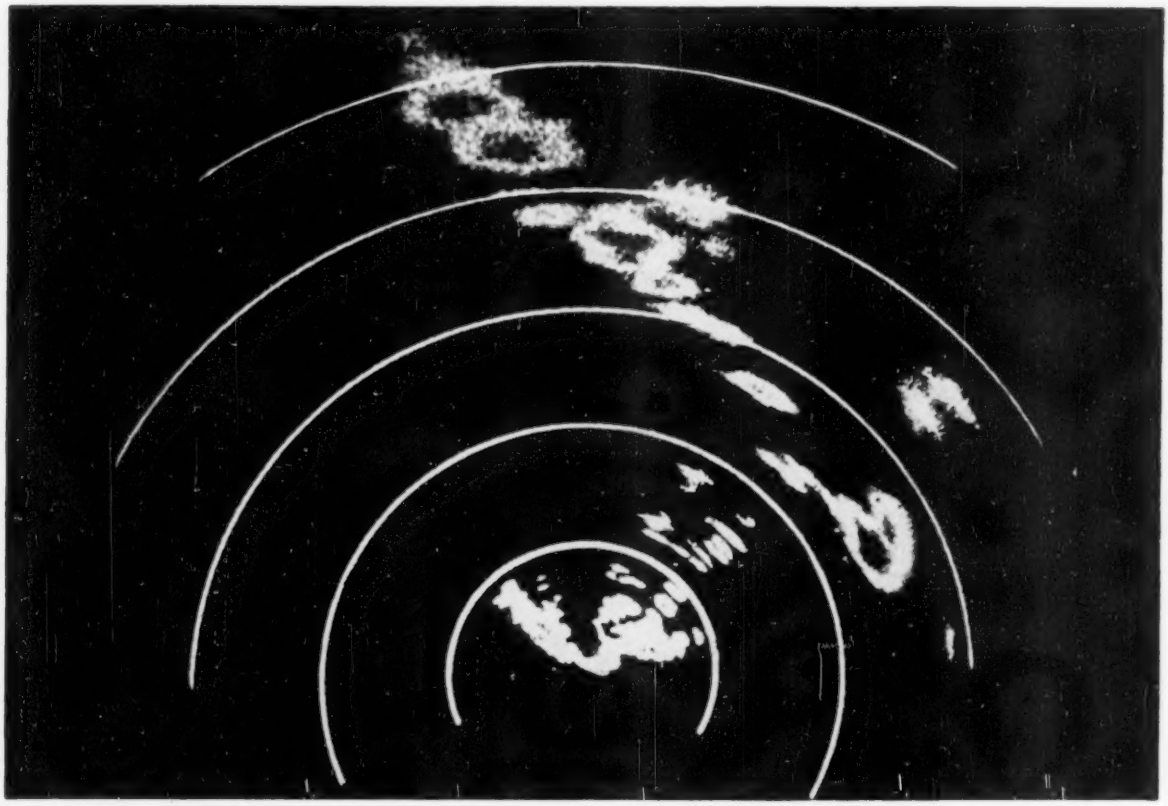

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With a slight detour from track, at cruise powers, the pilot can *see* his way around the storm . . . or through the less turbulent areas.

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It means improved flight safety through storm areas, reduces structural damage from turbulence and hail. Will pay for itself by improved flight schedules, minimized flight course detours and flight cancellations.

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WHO'S WHERE

In the Front Office

C. W. LaPierre has moved up to vice president in charge of General Electric Co.'s Atomic Energy and Defense Products Group, umbrella organization over GE's Aircraft Gas Turbine, Aeronautic and Ordnance Systems and Atomic Products Divisions. He also will continue in his former job as general manager of the AGT Division. As group executive, LaPierre succeeds **J. W. Belanger**, new executive vice president in charge of the Industrial Products and Lamp Group.

E. K. Foster, vice president of Bendix Radio Corp. at Detroit, is new group executive in charge of four divisions, including Bendix Radio. **Maurice W. Horrell** has been promoted to general manager of the Bendix Computer Division at Los Angeles.

Changes

David Keith-Lucas has become director and chief engineer in charge of Short Bros. & Harland's regrouped design teams at Belfast, Northern Ireland. Other changes: **R. Boorman**, chief structural engineer; **C. D. Hatton**, assistant chief engineer-aircraft; **F. H. Robertson**, chief project designer; **K. L. C. Legg**, structural development engineer; **F. P. Youens**, advance projects engineer.

Thomas E. Flannigan has been appointed assistant to the vice president-customer relations of Northrop Aircraft, Inc., Hawthorne, Calif.

Charles F. McElwain is new director of defense engineering and manufacturing for International Business Machines Corp., New York.

Kenneth L. Marshall will join Bristol Aeroplane Company of Canada, Ltd., Montreal, Jan. 1, as public relations director. **C. D. Davidson** has moved up to technical sales manager.

Charles H. Cannon has become mechanical and hydraulic staff engineer for Lockheed Aircraft Corp.'s Marietta, Ga., plant. **W. J. Broderick** is new sales co-ordinator for Lockheed-Georgia at the Sacramento (Calif.) Air Materiel Area.

Honors and Elections

T. G. Cole, vice president and comptroller of Delta-C&S Air Lines has been elected president of Air Transport Assn.'s 1955 Airline Finance and Accounting Conference. New vice presidents: **W. J. Short**, treasurer of Allegheny Airlines; **J. J. Taylor**, vice president and treasurer of Western Air Lines.

T. P. Fox, Associated Airways, Edmonton, Alta., has been re-elected president of the Air Industries and Transport Association of Canada. New vice presidents: **B. W. Pitfield**, Northwest Industries, Ltd., Edmonton, and **R. W. Ryan**, Canadian Pacific Airlines.

Kenneth A. Norton, chief of National Bureau of Standards' Radio Propagation Engineering Division at Boulder, Colo., has won the Stuart Ballantine Medal for radio research.

INDUSTRY OBSERVER

► Both USAF and Navy are interested in a piloted, rocket-powered research aircraft to reach altitudes of 100 mi. (over 500,000 ft.) for preliminary exploration of space problems. Highest penetration to date is just over 90,000 ft. by the Bell X-1A piloted by USAF Maj. Arthur Murray. Bell and Douglas both are interested in the space research aircraft.

► Most U. S. airframe designers with combat aircraft now flying above Mach 1 are recalling warnings given Congress several years ago by Drs. Jerome C. Hunsaker and Hugh L. Dryden of the National Advisory Committee on Aeronautics that stability and control problems above Mach 1 required considerably more research before solutions would be in sight. Virtually every USAF and Navy supersonic-fighter type now flying is in serious stability and control trouble at speeds above Mach 1 when imposing as little as 2G loads.

► USAF is experimenting with launching Lockheed F-80s from a Matador zero length missile launcher at Edwards AFB (Aviation Week Jan. 18, p. 10). Both pilotless and piloted flights have been made with F-80s from the Matador launcher without serious problems. Purpose of the USAF experiments is to study methods of fast takeoff for interceptors from unimproved facilities. Study also will include use of special landing mats equipped with Navy-type arresting gear.

► Boeing soon will begin tests at Wichita on very heavy gross weight takeoffs of the B-47 Stratojet bomber. Tests will be made on a 10,000-ft. runway under no-wind conditions.

► Future British interceptors will be armed with de Havilland air-to-air missiles using an infrared target-seeking guidance device. Delta-wing Gloster Javelin all-weather fighter may be the first RAF interceptor to carry the de Havilland missile.

► Although no official decision has been reached, Pentagon insiders are betting that the NATO lightweight fighter award will go to the Breguet Taon powered by Turbomeca jet engines. Folland's Gnat is reported to have been bypassed because of its limitations as a ground support aircraft. Meanwhile, the Folland Midge, prototype for the Gnat, demonstrated the supersonic capabilities of the Gnat design by diving past Mach 1 several times with only a slight change in trim reported by its test pilot.

► Fairey Aviation has received a Ministry of Supply contract for a lightweight helicopter aimed at British army use.

► Army is after increased range for Nike to eliminate a serious deficiency in its present combat usefulness. Bell Aircraft Corp. and Aerojet-General Corp., who share the present Nike rocket motor production, are working on more powerful propulsion systems for this missile. Development of a frangible booster for Nike is another unsolved Army problem. Heavy booster casings now are a menace to persons and property in the vicinity of Nike batteries when they fall after disengaging from the missiles. More than 1,000 subcontractors are involved in the Nike guided missile production program for the Army.

► Chrysler Corp. reports schedule slippage on its production plans for the Army's Redstone bombardment missile developed by former German scientists at the Redstone Arsenal, Huntsville, Ala. The Redstone missile was scheduled for production early this year at the government-owned Chrysler plant near Detroit, built originally for jet engine production. Now Chrysler admits the Redstone missile still is in a development stage at its plant and production is at least some months in the future.

► Satellite search program for Army ordnance at White Sands Proving Ground (Aviation Week Aug. 23, p. 12) has produced a telescope-camera capable of photographing the 46-ft.-long V-2 rocket at the distance of the moon from the earth. Dr. Clyde Tombaugh, discoverer of the planet Pluto, supervised the program.

Washington Roundup

Renegotiation Out?

The renegotiation law, which expires Dec. 31, probably will not be revived by Congress.

Congressional consensus at the time the law was extended through 1954 last spring was that another extension would not be approved unless an emergency developed. The Renegotiation Board, however, will not be dissolved. It will take about 18 months to clear up the backlog of cases. Renegotiation has been in effect since 1942 except for a two-year lapse from 1946 to 1948. It was revived as a provision of the fiscal 1948 Defense Appropriation Act. The 1951 Renegotiation Act established an independent board that covered all contracts by government agencies in addition to the military services.

Military Foot-Dragging

Reluctance of military services to cooperate with the Small Business Administration has drawn sharp criticism from Capitol Hill.

The Joint Congressional Committee on Defense Production reports foot-dragging by the Army, Navy and Air Force in joint determination procedure by the services and SBA over the share of defense contracts for small firms.

At one time, the Department of Defense issued a directive aimed at eliminating SBA representatives from procurement centers. The Army followed this with an order widely interpreted by procurement officers as authority to discontinue joint determination. Another directive, the committee said, ordered that no further drawings or specifications be furnished to the Small Business Administration.

Finally, after reaching agreement on 11 proposals effecting joint determination, the Defense Department ordered the services to cooperate. The Army simply reprinted the directive without specific instructions; the Air Force took almost two months and the Navy five months to instruct field offices.

Wilson to Stay

Secretary of Defense Charles E. Wilson, scotching rumors of his resignation, said he has no intention of leaving his cabinet post "unless the good Lord takes a hand."

Whose Figures Are Right?

Washington observers continued to be puzzled by the wide discrepancies between the firm contract obligations for aircraft announced by the Air Force and Navy and the figures on the same subject compiled by the Department of Defense comptroller's office.

For example, during September and October, just before the congressional election, USAF and Navy announced new contracts totaling more than $2 billion. For the same period, Defense Department figures show aircraft obligations of only $1.2 billion. The Defense figures are net obligations while USAF and Navy figures represent only new contracts without subtracting the value of canceled contracts. However, USAF and Navy did not announce cancelation of over $1 billion in aircraft contracts during September and October.

Meanwhile, USAF and Navy expenditures for aircraft continued at a lively pace with $617 million spent in September and $725 million in October. Total of aircraft expenditures for the first four months of fiscal 1955 is $2.7 billion, leaving an unexpended balance of $24.1 billion.

Tighter R&D Rules

The Defense Department is tightening its grip on research and development programs.

The Army, Navy and Air Force now must inform the Assistant Defense Secretary for Research and Development on new and revised projects. Data on new jobs must be submitted to Defense before the items appear in budget proposals. The three services are "responsible for inter-departmental coordination of each new research and development project of joint interest." Defense must be informed about this coordination. In addition, Assistant Defense Secretary (Research and Development) Donald A. Quarles and Assistant Defense Secretary (Applications Engineering) Frank D. Newbury have set up committees in their offices aimed at "achieving sound, coordinated and integrated programs in their respective areas of interest."

The new program has no connection with congressional criticism of the guided missile research and development program, Defense claims. Newbury heads a group now preparing a missile report for the Senate Appropriations Committee, due Jan. 15.

At the same time, both the Defense Department and the armed forces are preparing comments on the Riehlman Report, a House subcommittee study that criticized manpower utilization in research and development. Comments are due in January.

Air Force on TV

After several years of fumbling by Aircraft Industries Assn., the U. S. Air Force has picked up the ball and scored a major public relations victory in an agreement with the Columbia Broadcasting System to produce "Conquest of the Air," a series of 26 half-hour television programs (AVIATION WEEK Oct. 25, p. 108). The series will be broadcast coast to coast, is scheduled to start next fall.

Idea of Aircraft Industries Assn. sponsorship of a similar series or feature-length motion picture has been kicked around industry public relations circles for many years, with particular attention given to it for last year's Golden Anniversary of Flight celebration. Following the 1953 failure to agree on format, United Aircraft Corp. produced "We Saw It Happen," a documentary film based on recollections of aviation pioneers that got wide TV coverage.

The industry group always has been hampered by professional rivalry, competitive products and strong diverse opinions about the historical value of accomplishments. Result: the project never got off the ground.

USAF now has a schedule set up whereby CBS will provide editing talent to compile the entire story of flight from Kitty Hawk into the future. More than 150-million feet of existing film, much of it in USAF's depository at Dayton, will be made available to network editors along with technical guidance from Col. Robert L. Scott, Jr., author of "God Is My Co-Pilot." The TV series will feature the Air Force story, rather than that of the aircraft industry. —Washington staff

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Experts Describe Big Strides in Missiles

- **Army's Gen. Simon points to substantial gains made in nearly every phase, from theory to technology.**
- **Weights have been slashed and reliability improved by application of new knowledge and techniques.**

By David A. Anderton

Significant advances in guided missile technology were revealed by Maj. Gen. Leslie E. Simon, assistant chief of ordnance for research and development, at the Dec. 2 Honors Night dinner of the American Rocket Society.

Simon pointed to substantial progress in almost every phase of missile science, from pure theory to manufactured components, citing the ". . . amazing technological advance in rocketry in the last decade."

Highlighting his presentation were specific data on remarkable weight savings achieved through increased knowledge of operating conditions and improved fabrication techniques.

▶ **Wartime Foundation**—Built on the success of the unconventional weapons developed in the emergency of World War II, the missile program today has followed the same pattern of basic research, component development and item development, Simon said. But the pace has been much swifter because of increased financial support and more knowledge on how to go about the business.

Simon cited improvements in current missile structure, achieved by research and development spurred on by design requirements for more range and higher speed. Complicating the problem were the high temperatures caused by skin friction, hot enough to soften steel and aluminum alloys.

Solution of the problem has been through better understanding of the stresses imposed on missile structures, through improved materials and through new cooling techniques.

Conventional practice has been to use strength data based on infinite life and steady-state temperatures but a ballistic missile has only a short life and short exposure to high temperatures. Simon said research has shown that the specific conditions of ballistic missiles permits designing them on a short-life, short-exposure basis.

One specific ballistic missile, made of low-alloy steel, has been designed to a working limit 50% higher at about 1,100F through a realistic knowledge of its operating conditions.

▶ **Design Aids**—Improved reliability is an important product of developments in structural analysis, because the availability of electronic computers means that more conditions can be analyzed more accurately in a shorter time.

(Observers remembered that before the days of computers, structural criteria were based on aircraft practice or designers' experience, and often overlooked some unusual condition which proved critical much later in the program.)

Simon said the use of computers has paid off in flutter analysis and in evaluating a multitude of load conditions.

▶ **New Methods**—He compared missile-component weights today with those of 10 years ago. A rocket body section has been reduced to a point where the ratio of dry weight to total impulse (the product of thrust and firing duration) is 38% of the figure for 10 years ago. Reason: new manufacturing methods for thin-walled pressure vessels of steel and aluminum alloy.

Pressure spheres, generally used to supply an inert gas under pressure in place of a pump system, have been reduced in weight by 35%, Maj. Gen. Simon added.

Substantial weight savings can be achieved by using glass fiber in tension.

▶ **Guidance and Control**—Guidance long has been rated as the most difficult area in missile development. "Although much progress has been made in guidance and control, it is the field in which progress is most striking about which I can say least," Simon said.

"Air-tight defense has dictated a concerted and dedicated research effort in guidance equipment alone. One might say that the postwar missile guidance systems started essentially from zero, but many of the essential components of the guidance systems existed long before the close of World War II. . . . It has been necessary to modify and redevelop much equipment and many techniques in order to make them useful. . . ."

These specific contributions were cited:

- **Better magnetrons and klystrons** for a wide range of power and frequency.
- **Greatly improved accuracy for** gyros and accelerometers.
- **Increased avionic reliability** because of transistors, magnetic amplifiers, printed circuits and a new ceramic tube (AVIATION WEEK June 28, 1954, p. 61.)

". . . Substantial progress has been made in every guidance system considered feasible, including beam riding, celestial navigation, command, homing, inertial and radio navigation control," Simon concluded.

▶ **Thrust Units**—In propulsion, the Army missile chief pointed to these milestones:

- Understanding combustion stability which had led to efficient, lightweight and high-thrust motors typified by the Corporal liquid-propellant rocket.
- Development of relatively stable nitric acid (used as an oxidizer in rockets).
- Uncooled motors for moderate performance (such as the Nike sustainer liquid-fuel rocket) protected by liners of silicon carbide, zirconium and graphite.
- Processing of large solid-propellant rocket charges, now limited in size only by the ingenuity of the engineer and the supply of ingredients.
- Discovery and development of temperature-insensitive solid propellants, with the result that combustion chamber pressures remain uniform over the range of operating temperatures. This means a lighter motor design.
- Development of refractory coatings and other new materials, even including such products as plastics and fiberglass for motor walls.

▶ **Lift and Drag**—In aerodynamics, Simon said that analytical methods can be used much more extensively now than before, because of the advances made in aerodynamic theory. Lift and stability calculations have been improved in accuracy. Supersonic nozzle design is an improved procedure. The mechanics of new and different fluid flows—unsteady, hypersonic, very low density—are understood more fully.

Supersonic skin friction and heat transfer now can be predicted if the state of the boundary layer is known.

Simon added. Much valuable data has come from the Upper Atmosphere Program, conducted with a variety of research rockets and balloons since 1946.

▶ **Reliability**—Simon stressed the application of statistical methods and theory to missile testing and quality control, for increased reliability and performance of field units. "We are now beginning to learn means of widening tolerances on guidance circuits so that they will perform within acceptable limits under tactical environments previously unexpected, with a net gain in performance and cost."

Simon paid tribute to the forward strides in manufactured components which he said have contributed greatly to cheaper, available, improved assemblies and better missile systems.

▶ **Seminar**—At another missile meeting, a seminar sponsored by the American Ordnance Assn., the Navy stole the show with first films of its Terrier surface-to-air missile and Sparrow air-to-air weapon. These new additions to Navy's arsenal were shown during early test firings against drone Grumman F6F Hellcats.

Simon, also present at the meeting with missile chiefs Rear Adm. J. H. Sides, USN, and Brig. Gen. B. F. Kelsey, USAF, emphasized the "acceptable reliability (of missiles) is a current achievement," referring presumably to Army's Nike, Corporal and Honest John missiles. He said that in Ordnance's view, development of a product was completed only when it was producible in quantity and usable by the customer.

Adm. Sides said the Navy's formal evalution of the Convair Terrier, begun two years ago on the converted cruiser Mississippi, was completed recently. He added that Terrier, along with Sperry Sparrow and the Chance Vought Regulus surface-to-surface missile, is now in fleet hands.

▶ **Single Primes**—Gen. Kelsey said there was near-coincidence in missile requirements for naval air use and the USAF, particularly in air-to-air weapons. He pointed out that missiles are multipliers for the manned forces, rather than replacements.

All the services use the concept of the single prime contractor, said the officers. Ordnance wants to use the idea —which it calls the "big package deal" —as a means of giving the contractor maximum freedom. Navy, having tried three methods (development lab to producer, conventional aircraft procurement with GFP, and single prime contractor), would settle on either first or last method.

Moderator of the seminar was Donald A. Quarles, Assistant Secretary of Defense (Research and Development). Other guests included Frank B. Newbury, Assistant Secretary of Defense (Applications Engineering) and chairman of the Guided Missiles Program survey committee, and K. T. Keller, former director of guided missiles for the Department of Defense.

Report from Formosa:

Reds Control Sky Over China Sea

Military observers say only aircraft of U. S. 7th Fleet can keep Tachen Islands from falling to Communists.

By Dan Kurzman

(McGraw-Hill World News)

Taipei—The Chinese Nationalist-held Tachen Islands could fall to Red China by next spring unless the United States decides to risk allout war with Peking by committing carrier-based planes of the U.S. 7th Fleet to their defense, many top American and Nationalist military leaders believe.

Red Air Force today has overwhelming control of the skies between the mainland and Formosa. Undercover of this air fleet—an armada of junks, sampans and rafts—probably could take these islands even if subjected to shelling by American warships. The Reds might suffer heavy losses, but a good part of their force would sneak through.

If the 7th Fleet did try to turn back an invasion, its ships might be bombed by Red planes. Thus, if the U. S. commits itself to defend the offshore islands, not only the vessels but the planes of the fleet must be ready for combat.

▶ **Springtime Invasion**—Even utilization of these planes might not be enough to attain air superiority or a large measure of it over the offshore islands. Once committed, some Americans believe, it may be necessary to bomb Red airbases along the coast at Ningpo, Shanghai, Nanking, Hangchow, Chuchow, Nanchang and Canton.

An invasion effort probably would not be attempted before spring because of the unfavorable winter weather.

Most Nationalist and American military leaders here call the risk of an allout war worth taking. While conceding the islands are of little military significance, they believe loss of the Tachens would be a tremendous psychological victory for the Reds.

Moreover, it is pointed out, an excellent radar and listening post would be lost although others still would be available on Matsu and Quemoy—easier to defend than the Tachens. On the other hand, there are no good substitutes for the Tachens as a radar site to detect planes attacking Okinawa.

▶ **'Dienbienphu' Risk**—A minority view among American and top Nationalist militarists holds that defense of the Tachens could turn out to be another Dienbienphu, with liquidation of the entire Nationalist garrison of more than 8,000.

About one-third of the Republic of China's 250,000 combat troops are dangerously scattered on offshore islands.

Red air superiority is due to a number of reasons:

• **Nationalist planes** must fly more than 200 mi. to the Tachens, compared with the 30 or so miles Red planes must cover.

Some Nationalists suggest America can avoid an air war by putting a U.S. carrier at the disposal of the Chinese Air Force. Americans say this is impracticable, because Chinese pilots have had no carrier training.

• **Red Air Force** superiority in numbers and quality is the most important reason for Communist control.

The Nationalists have five fighter wings, totaling less than 500 aircraft. Included are two wings converted some months ago to F-84s from F-47s, one F-47 wing just now beginning to switch to F-86s, one F-47 wing and one RF-51 wing. They also have the equivalent of between one and two light bomber wings equipped with P4Ys, B-24s and B-25s.

The first four F-86s arrived Nov. 29. The Chinese wing organization is approximately equal to a U. S. wing, so an additional 71 Sabres are expected. Fifty additional Thunderjets are needed to bring the F-84 wings up to strength from their present combined total of 100 aircraft.

Yank-trained Nationalist pilots are rated equal to American pilots, except in night and instrument flying proficiency.

▶ **Communist Edge**—F-47s and F-48s are no match for MiG-15s, which are far faster and more maneuverable. The Reds have about 600 MiGs besides 300 TU-2 light bombers, 10 TU-4 heavy bombers, 150 IL-28 jet bombers and 300 LA-9 and -11 fighter-bombers.

The Nationalists strongly feel that aircraft shipments from the U.S. are much too slow. They asked for three F-84 wings, maintaining that 500 of these jets would give them air superiority.

But, it is believed, the American advisers recommended one wing. There is no indication when another batch of F-86s will arrive.

Heat 'Barrier'

- **Engineers say problems surpass those of fatigue.**
- **This aerodynamic area needs new safety factor.**

The "thermal barrier," as fictitious a phrase as the now-rejected "sonic barrier," received the lion's share of attention at the recent annual meeting of the Aviation Division of the American Society of Mechanical Engineers.

Nine papers—almost half the total number of presentations during the three-day session—were based on the theme of the "thermal barrier," an entirely different domain of flight rather than a single obstacle.

From the theory of heat transfer at high speeds to the very practical human problems associated with high temperatures, the engineers and scientists considered the aspects of flight at speeds hot enough to soften the structural materials of today's airframes.

▶**Two Typical**—Two Lockheed engineers predicted castings might be used for the high-temperature applications because casting materials show larger allowable creep stresses than the usual wrought alloys. In their paper, "Problems in the Design of Aircraft Subject to High Temperature," engineers F. R. Steinbacher and Louis Young of Lockheed's Burbank, Calif., headquarters, covered the factors entering into the design of airframes.

Fatigue, they pointed out, is a minor problem compared to creep. The reason: For many materials, the fatigue strength drops off more slowly than does the static strength as temperature increases.

The engineers recommended the development of alloys with a low coefficient of expansion to reduce the thermal stresses imposed by differential expansion of unevenly heated structures. They said the development well might make the difference between a practical aircraft and one too heavy to fly.

A new safety factor is in the cards, they said. Load-carrying ability alone is no longer a sufficient criterion for strength—creep, time, temperature or stress may be the critical factor in structural integrity. They suggested a coordinated study by industry, military and CAA to tackle this problem.

One more angle: The authors see far-reaching effects on subcontracting, vendors and management decisions because of temperature problems. Much of the accumulated data of the past 20 years of working with aluminum alloys will have to be junked, to start new with a different material.

▶**Floor Sweepers**—The authors predicted that structural problems soon will hamper the new designs of aircraft, unless something basic is done to rectify the difference between the demand for new data and the supply of new research. "The opinion is already held that research is today merely sweeping up after the designers . . . . Structural research, unless accelerated, will soon find itself five to 10 years behind aerodynamics and propulsion."

In another presentation, George Gerard, assistant director of the College of Engineering Research Division, New York University, said sustained flight might be limited to Mach numbers below 3.5 because of the terrific weight penalty of providing adequate structural strength at high temperatures.

Gerard recommended extensive use of integral construction for substantial weight savings in the high-solidity structures required. He said limited life expectancy of airframes may be used as one solution to the problem of flight under the stress of high-temperature conditions. —DAA

NORTH AMERICAN AIRLINES' DC-6B will open nonstop L. A.-N. Y. service Dec. 18.

Nonsked Gets 102-Seat DC-6Bs

North American Airlines, nonsked transcontinental carrier, expects to begin daily nonstop DC-6B aircoach service from Los Angeles to New York Dec. 18 with the first of two DC-6B purchased from Douglas Aircraft Corp.

The planes were bought at a unit cost of $1.3 million. The second aircraft is scheduled for delivery within a month.

Fitted with 102 seats, NAA's new equipment is claimed to be the first ever designed by Douglas exclusively for longrange coach operation.

▶**Under Eight Hours**—The airline estimates the nonstop Los Angeles-New York flight will take 7 hr. 55 min., while the run from New York to Los Angeles, with a stop at Chicago, will take about 9 hr. 30 min. Eastbound flights will depart from Los Angeles at 10:30 p.m. (PST), while return flights will leave New York at 11 a.m. (EST).

The nonsked also plans to inaugurate DC-6B service between New York and Miami later. DC-4s presently are used.

"This move on the part of North American Airlines brings this fastest transcontinental aircoach flight at the lowest fares of any major airlines and the only nonstop DC-6B coast-to-coast aircoach service to the public," a company spokesman says.

In addition, the airline has increased its advertising budget for the coming year to $1 million—about $200,000 over 1953.

▶**More DC-6Bs**—Fare on the DC-6Bs will remain the same as that on its DC-4 flights, North American reports.

A company executive says negotiations now are under way to acquire two more DC-6Bs "from other airlines." North American plans eventually to replace all six of its DC-4s with DC-6Bs, he says.

The nonscheduled airline also is preparing to lower fares on its DC-4s after both DC-6Bs are in operation.

Douglas-El Segundo Sets Wage Pattern

El Segundo, Calif.—Douglas Aircraft Co.'s El Segundo Division and members of the International Association of Machinists (AFL) reached agreement last week on a new contract that may set a pattern for aircraft industry negotiations now under way at other plants.

The El Segundo settlement provides an average wage boost of 9½ cents an hour, with blanket increases ranging from five to seven cents and three cents additional in the health and welfare program. Some 21,000 employes at the El Segundo and Torrance plants are covered by the agreement, which will extend to Mar. 31, 1956.

Negotiations still were under way between the IAM and the Santa Monica Division of Douglas, Lockheed Aircraft Corp., and Convair at San Diego. United Auto Workers (CIO) was negotiating at Douglas-Long Beach, Douglas-Tulsa, and North American Aviation.

Navy Calls Carrier Vital Weapon

Air aide strikes back at Montgomery criticism, claims sea-based aircraft have 'massive retaliatory ability.'

By Claude Witze

The United States Navy does not agree with Britain's Field Marshal Montgomery that modern land-based aircraft "have solved the problem of endurance in the air."

It does believe there are many obsolete items in our arsenal and that they should be abolished, but the aircraft carrier is not one of them.

Further, in what may be a re-opening of old wounds in the argument with the Air Force over longrange strategic bombing, the Navy holds that the carrier has "massive retaliatory ability" as an offensive weapon.

► **Weapons Evaluation**—All three points were made last week by Assistant Secretary of the Navy for Air James H. Smith, Jr., in reply to Montgomery's advice that no more money should be spent on carriers (AVIATION WEEK Dec. 6, p. 12).

Smith refused to expand on his opinions that land-based planes still have limited range and that there must be a cutback in outmoded weapons. He said he did not want to get into controversial fields, but it is important that the U.S. realistically evaluate its weapons to eliminate any that do not warrant high priority in the face of the atomic threat.

The only specific example cited by the assistant secretary was destroyer functions now taken over by aircraft: patrol missions, early warning radar picket planes and helicopters used to screen task forces against submarines, as well as missiles.

► **Navy Sensitivity**—Smith spoke out following a tense week in the Pentagon, during which the Navy clearly was upset by Montgomery's remarks but was exercising some caution to avoid controversy.

Factors contributing to Navy's sensitivity:

- Montgomery spent considerable time with President Eisenhower and pushed his doctrine in an effort to influence current debate in the American high command over military policy.
- His statement was made almost on the eve of the launching of the U. S. S. Forrestal, first of the 59,900-ton supercarriers, which went down the ways at Newport News last Saturday.
- Montgomery was in the U.S. as a guest of the Air Force. His endorsement of airpower and his conviction that the problem of endurance in the air had been solved became stronger while he was associated with USAF.
- His criticism of carriers came on the eve of the annual struggle with Congress for fiscal 1956 budget approval. Funds for starting work on a fifth carrier of the Forrestal class are included.

The Navy program faces criticism in Congress. The Montgomery speech was inserted in the Congressional Record by Sen. Barry Goldwater (R., Ariz.), veteran of four years' service in USAF and a jet pilot in the USAF Reserve.

► **Mobility, Versatility**—Assistant Secretary Smith's defense of the carrier was based, at least in part, on an effort to show that the Navy's air arm is equipped to carry out Montgomery's own program for defeat of an enemy.

He listed basic points from Montgomery's thesis, claiming that planes based at sea meet all the requirements for mobility, versatility, logistic simplicity, dispersal and the ability to divert the foe.

He said Montgomery had nothing new in his idea that more funds and effort should be put into airpower. Smith said this policy already is in force at the Pentagon and that further progress will be made as a result of modern research and development, which is "obsoleting weapons at a pretty fast rate." He refused to name the weapons.

► **Seaplane Bombers**—Smith made a strong case for future adaptability of the flying boat for the delivery of atomic bombs, clearly envisioning its use in strategic bombing. He cited the P6M SeaMaster, Glenn L. Martin Co.'s new seaplane that will fly next spring (AVIATION WEEK Oct. 18, p. 11).

The first P6M will be powered by four Allison J71 turbojet engines with afterburners, installed on the test vehicle originally scheduled to carry Wright J67s.

The SeaMaster, which can be refueled at sea from a submarine tanker, was described by the assistant secretary as a multi-purpose plane with a big bomb bay, holding "high promise."

► **Early Seaplane Efforts**—The Navy's program to utilize a seaplane-submarine team for longrange delivery of atomic bombs goes back to the days of the Air Force-Navy dispute over responsibility for strategic warfare, a mission given to USAF by the Joint Chiefs of Staff. Nearly 10 years ago, one submarine was converted to an underwater tanker for experimental use.

During World War II, the Japanese made an attack on Hawaii, in March 1942, using two Emily flying boats based on Wake Island and refueled at sea by tanker submarines.

Use of seaplanes and submarines for longrange strategic attacks was a project promoted by Capt. C. H. (Dutch) Schildhauer, famous proponent of flying boats. Even before development of seaplanes capable of the SeaMaster's performance and the atomic-powered submarine, Schildhauer argued that a flying boat could make an attack on a land target 2,000 mi. from its last refueling point, where it would rendezvous with a submarine (AVIATION WEEK Nov. 8, 1948, p. 12).

► **Pacific Problem**—Smith foresees the time when the flying boat will be nuclear-powered and capable of flying to and from remotely located tenders to pick up atomic bombs.

In direct refutation of the Montgomery contention, Smith said he could see no end to the need for mobile bases from which to launch air attacks and that he thought Montgomery did not fully appreciate the U.S. problem in regard to longrange bombing in the vast areas of the Pacific.

There was no doubt in the Pentagon

Rotorcycles Win $400,000 Contracts

Navy has awarded two $200,000 research and development contracts for one-man portable rotorcycles. Winners as reported in Aviation Week (Oct. 25, p. 11) were Hiller Helicopters of Palo Alto, Calif., and Gyrodyne Co. of America, St. James, N. Y.

Both companies are scheduled to produce flying prototypes of their designs within 12 months. The Hiller rotorcycle, designated XROE-1, uses a single two-bladed rotor and a small tail rotor. The Gyrodyne project, designated XRON-1, features co-axial, contra-rotating two-bladed rotors with a fixed-tail stabilizer.

Powerplant for both rotorcycles will be a four-cylinder, air-cooled Nelson piston engine manufactured by Barmotive Products, Inc., San Leandro, Calif.

Total of 30 separate designs were submitted by 18 manufacturers in the design competition sponsored by the Navy's Bureau of Aeronautics for the Marine Corps. The Marines are interested in the portable lightweight rotorcycle for observation, liaison, escape and evasion, and small unit tactical maneuvers.

Both the Hiller and Gyrodyne machines will be capable of quick assembly and dis-assembly and can be dropped by parachute and easily transported by small aircraft.

last week that the Navy's extreme concern about Montgomery's influence has led it into an offensive designed to carry weight when Congress takes another look at the "new look." When budget discussions start, makeup of the armed forces, as well as their missions, will come under close scrutiny. Interest will be heightened both by the necessity for renewing the draft law and by the Defense Department's strong determination to save money.

▶**Navy Fears Cut**—Defense Secretary Charles E. Wilson said last week that the next fiscal year's outlay for the armed forces "looks like $35.5 billion." He also said further economies may not be possible unless the world situation improves, so that his figure for the next fiscal defense budget stands at "plus or minus $2 billion."

Even if there is a drastic step to increase the defense budget, Congress can be expected to review closely the military expenditure plans, looking for every opportunity to squeeze more power out of every dollar.

Wilson already has indicated that USAF will get a bigger slice of the 1956 budget, and Air Force Secretary Harold E. Talbott said his fiscal 1956 request will run between $15 billion and $16 billion, an increase of $4 billion from fiscal 1954 and 1955.

It is clear that the Navy fears it will suffer if more money goes to the Air Force and overall expenses are held down while pay for military personnel is increased.

Tool, Facility Reserve To Get $100 Million

President Eisenhower and Defense Secretary Charles E. Wilson have approved a program to spend $100 million for reserve tools and facilities essential to the defense program.

Amount allocated to the aircraft industry was not disclosed because of security.

▶**Proposed Projects**—Wilson also released a new Defense Department directive on industrial production facilities, providing that the Army, Navy and Air Force must give an annual statement on proposed industrial facility projects.

Starting with fiscal 1956, the Defense Secretary will demand a list showing the estimated cost, capacity presently available and planned utilization for each project.

Under the directive, secretaries of the armed services can approve industrial facility projects only when the estimated cost is less than $1 million. Projects of more than $1 million must be approved by the Secretary of Defense.

▶**Long Lead Time**—The $100-million program approved for fiscal 1955 will be carried out through normal purchasing channels. Army, Navy and Air Force have been authorized to proceed with approved projects.

Thomas P. Pike, Assistant Secretary of Defense for Supply and Logistics, says the money "will be used entirely for the purchase of long production lead time machine tools for mobilization reserves."

Martin Starts Nuclear Reactor Development

Glenn L. Martin Co. is the latest aviation firm to enter the nuclear aircraft field.

The Baltimore aircraft builder has formed a Nuclear Division to produce nuclear reactors and related components for military, industrial and commercial use.

"Work already under way on reactor components includes development and fabrication of heat exchangers," Martin says, "and studies on the nuclear applications of stainless steel honeycomb developments."

This indicates the company has a government contract for nuclear propulsion and airframe work, although Martin would not confirm that federal funds are involved.

Dr. Theodore Von Karman

Von Karman Receives Astronautics Award

Dr. Theodore Von Karman received the American Rocket Society's first Astronautics Award at the organization's Honors Night dinner in New York, presented for his early encouragement of space flight studies.

It was the second award in less than two weeks for Von Karman. He won the Wright Brothers Memorial Trophy Dec. 4 (AVIATION WEEK Dec. 6, p. 7).

Von Karman, chairman of the Advisory Group for Aeronautical Research and Development of the North Atlantic Treaty Organization, backed the study of astronautics in the late 1930s while director of the Guggenheim Aeronautical Laboratory at California Institute of Technology.

▶**Powerplant Award**—Second new honor granted by the society was the James M. Wyld Memorial Award, won by Milton Rosen of the Office of Naval Research.

The award is named for the inventor of the regenerative rocket motor, basic design used in all current rocket powerplants. The award is given for outstanding application of rocket power. Rosen won it for his work with the Viking research rocket.

Other society honors went to A. M. O. Smith of Douglas Aircraft Co.'s El Segundo Division, who received the Robert H. Goddard Memorial Award for achievement in liquid-propellant rocket development; Dr. H. W. Ritchey, technical director of Redstone Division of Thiokol Chemical Corp., who received the C. N. Hickman Award for contributions to solid-propellant rocket work; Dr. Martin Summerfield, professor at Princeton University, who received the G. Edward Pendray Award for contributions to the literature of rockets and jet propulsion.

▶**1955 Officers**—Earlier, the society's board of directors announced the officers and directors of the ARS for 1955.

New president is Dr. Richard W. Porter, manager of General Electric's guided missile department. Vice president is Dr. Noah S. Davis, Jr., special projects manager for Buffalo Electro-Chemical Co., division of Food Machinery & Chemical Co.

New directors of the society for three-year terms: Dr. Wernher von Braun, chief, Guided Missile Development Division, Redstone Arsenal, Huntsville, Ala.; Andrew G. Haley of Haley, Dotey & Wollenberg, Washington, D. C.; Milton Rosen, head, Rocket Development Branch, Office of Naval Research, Washington, D. C.

RAAF Air Plant Tour

A seven-man Australian mission headed by RAAF Air Vice Marshal Alastair Murdoch this week will start a 42-day tour of aircraft factories in the United States.

The group will survey aircraft and production facilities for the purpose of making recommendations on types of planes for purchase and use in the RAAF.

They are interested primarily in transport and fighter-type aircraft.

FIRST MILITARY HELIPORT has eight copter landing pads radiating from perimeter.

U.S. Opens First Military Heliport

U.S. Army opened the world's first military heliport at Ft. Eustis, Va., last week amid fresh evidence that its pioneering work with rotary wings has a profound effect on commercial helicopter programming.

Two leading speakers at the Ft. Eustis dedication ceremony, in addition to Igor Sikorsky, engineering manager of Sikorsky Aircraft, and Maj. Gen. Paul F. Yount, Army chief of transportation, were Earl D. Johnson, president of the Air Transport Assn. and Joseph P. Adams, Civil Aeronautics Board member.

► **Military Help**—Johnson gave credit to the Army for "providing the airlines with valuable information and practical experience for the future development of civil heliports in the interest of the traveling public."

He called the Army ceremony "an instance of the intimate relationship between military and civil aviation."

Ft. Eustis, headquarters of the Army's Transportation School, has named the new heliport in honor of Warrant Officer Alfred C. Felker, a graduate of the first Army Transportation Helicopter Course at Ft. Sill, Okla., who was killed in an accident in 1952.

► **Landing Pads**—The field is in the form of a wheel with a circular taxiway on the outside. It is divided into quarter-sections by two black-top 600-foot runways. There are eight circular landing areas around the outside edge.

The dedication ceremony was marked by an elaborate helicopter demonstration with Bell, Sikorsky, Hiller and Piasecki aircraft. The Army showed how rotary wings are used for cargo hauling, evacuation, and other purposes utilized during the war in Korea.

Collier Trophy

The Collier Trophy for "outstanding achievement in aviation" for 1953 has been awarded to James H. Kindelberger, chairman of the board of North American Aviation, and Edward H. Heinemann, chief engineer of the El Segundo Division of Douglas Aircraft Co., "for development of the first supersonic fighter airplanes in service."

The award announcement by Thomas G. Lanphier, president of the National Aeronautic Assn., pointed to Kindelberger's contribution to development of the North American F-100 Super Sabre and Heinemann's role in developing the Douglas F4D.

The F-100 captured a world's speed record of 755.149 mph. over a 15-km. course Oct. 29, 1953. The F4D became the first carrier-type plane to hold an official world speed record when it flew a 3-km. course at 752.943 mph.

Present production models of both aircraft are powered by the Pratt & Whitney Aircraft J57 turbojet engine.

Court Battle Opens Over 3-Cent Airmail

Department of Justice has opened the government's legal battle with the railroads over three-cent-mail-by-air, asking a federal court to throw out a rail suit on the grounds that the railroads have no legal business trying to stop the Post Office Department's West Coast experiment (AVIATION WEEK Nov. 29, p. 12).

The Justice Department brief was filed in the District of Columbia federal district court in answer to a request for injunction and declaratory order filed by five western railroads.

The rail carriers asked the court to stop the West Coast mail experiment by injunction and issue an order finding that the Postmaster General has no authority to institute surface-mail-by-air service.

Government counsel says the court should deny the railroad request on any one of the following grounds:

- **The railroads** have no legal right to ask review of the Postmaster General's action.
- **The Postmaster General** has the authority to arrange for experimental air movement of first-class mail.
- **Preliminary injunction** should be denied even if the Postmaster General's action were of doubtful validity, because it would be detrimental to the public interest.

According to the Justice Department, the railroads have no legal interest in the transportation of United States mail. The only interest they can establish is "an interest in continuing to engage in the business of transporting the mail and an interest in immunity from economic competition."

Even if the railroads had a legal interest, says the Justice Department, the action of the Postmaster General is authorized by law and has the sanction of Congress, the Comptroller General and the Civil Aeronautics Board.

Navy Awards Engine, Plane Parts Contracts

Navy has awarded more than $20 million in engine contracts to Pratt & Whitney Aircraft Division of United Aircraft Corp. for J48 and J57 turbojets.

The East Hartford, Conn., powerplant manufacturer received two J57 orders totaling $13,343,241 and $1,258,824 and $5,870,040 for J48s.

Other new Navy awards:

Sikorsky Helicopter Division, United Aircraft Corp., Bridgeport, Conn., research and development, $943,014.

Douglas Aircraft Co., El Segundo, Calif., publications and handbooks, $279,818.

Lockheed Aircraft Corp., Burbank, Calif., aircraft parts and kits, $203,364.

Radio Corporation of America, Camden, N. J., design, develop and furnish radar sets, $144,000.

Edo Corp., College Point, N. Y., sonar equipment, $170,772.

Sperry Corp., Great Neck, N. Y., modification of certain components, $1,026,599.

Allen B. Dumont Co., Clifton, N. J., research and development, $153,000.

Texas Instruments Co., Dallas, electronic components, $2,507,985.

Hamilton Standard Division, United Aircraft Corp., East Hartford, Conn., aircraft engine starters, $2,181,788; propeller assemblies, $179,935.

North American Aviation, Inc., Columbus, Ohio, spare parts for AJ-type aircraft, $692,142.

Coleman Engineering Co., Los Angeles, research and development, $634,262.

All American Engineering Co., Wilmington, Del., research and development, $193,759.

McDonnell Aircraft Corp., St. Louis, spare parts for F2H aircraft, $155,759.

Cosmo Engineering Laboratories, Inc., Hackettstown, N. J., 13 acoustic devices with stock repair parts, $129,270.

Motorola, Inc., Chicago, radar data relay sets, $1,363,071.

John Bean Division of Food Machinery & Chemical Corp., Lansing, Mich., acoustic devices, $2,914,466.

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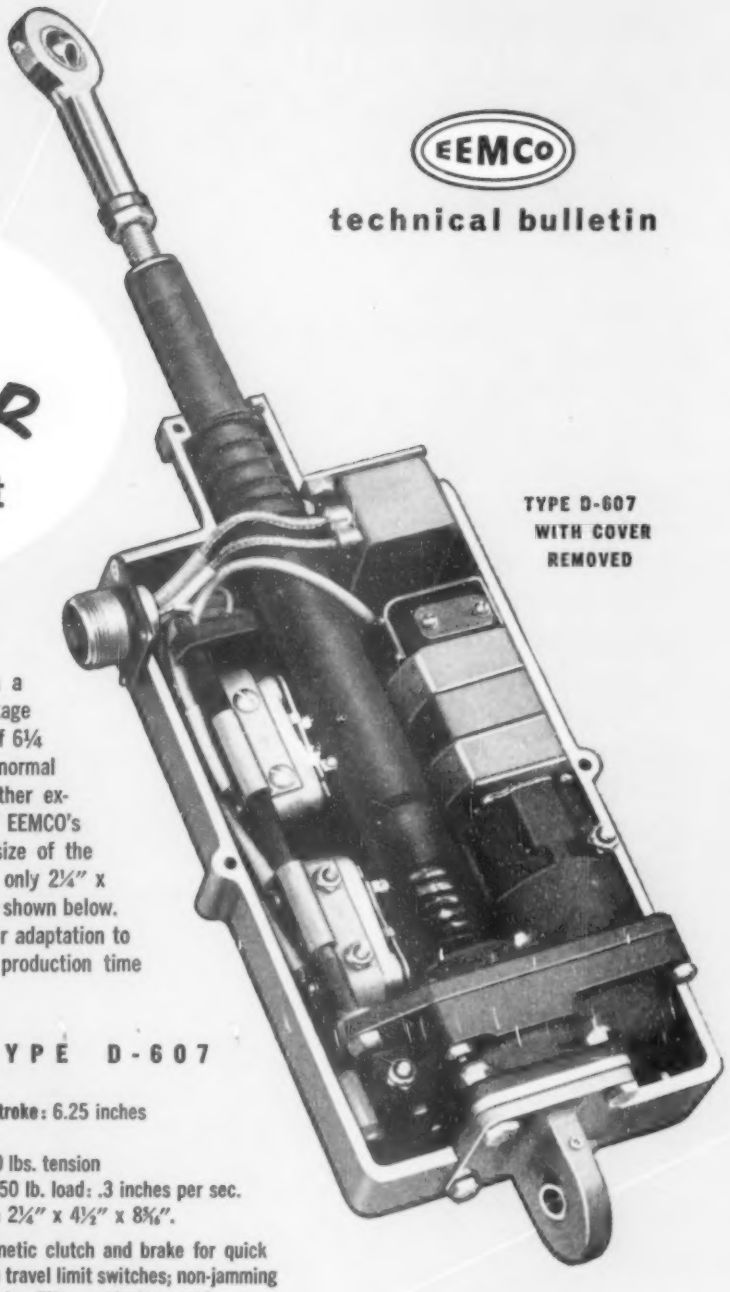

TYPE D-607 WITH COVER REMOVED

EEMCO's new linear actuator, Model D-607 is a compact combination actuator and power package weighing only 4½ pounds. Having a stroke of 6¼ inches at .3 inches per second under a normal operating load of 450 pounds, it is another example of the ingenuity and precision of EEMCO's design and production team. Overall size of the activating section of Model D-607 is only 2¼" x 4½" x 8⅜". Other specifications are shown below. This same design can be altered for adaptation to other uses with a minimum of production time thus assuring early delivery.

SPECIFICATIONS ★ TYPE D-607

Weight: 4.5 pounds **Stroke:** 6.25 inches
Operating load: 450 lbs.
Ultimate static load: 7150 lbs. tension
Speed of stroke under 450 lb. load: .3 inches per sec.
Size of power section: 2¼" x 4½" x 8⅜".

Other features: Magnetic clutch and brake for quick stopping; adjustable travel limit switches; non-jamming end stops; radio noise filter; explosion proof.

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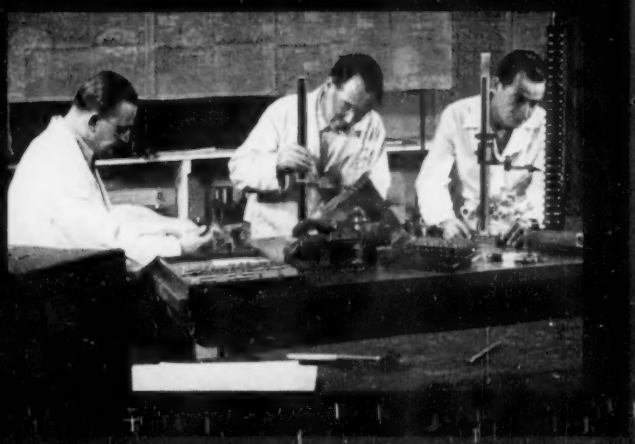

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RESEARCH AND MANUFACTURING OF HYDRAULIC AND PNEUMATIC AIRCRAFT EQUIPMENT

Air Force to Realign AMC Districts, Areas

U. S. Air Force's Air Materiel Command will realign Air Materiel Areas and Districts Jan. 1 so that a single set of boundaries will mark both supply and maintenance support areas and contract administration areas.

The double set of boundaries has been a source of confusion to contractors as well as USAF personnel, since 1953 when the Air Procurement Districts lost their separate entities.

Most of the changes to the Air Procurement Districts resulted from assignment of contract administration responsibilities to the Ogden Air Materiel Area, which involved the setting up of a new procurement district there. This made changes in the surrounding districts necessary.

Changes in the Air Materiel Areas:

• **Middletown (Pa.)**—Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Maryland, Delaware, Pennsylvania, and the District of Columbia. This area loses supply and maintenance support responsibilities for Michigan, Ohio, Indiana, and West Virginia.

• **Mobile (Ala.)**—Indiana, Ohio, West Virginia, Kentucky, Tennessee, Mississippi, Alabama, Michigan (less the upper peninsula), Florida west of the Apalachicola River and Louisiana east of the Mississippi River. This area gains Ohio, West Virginia, Indiana and most of Michigan.

• **Oklahoma City (Okla.)**—Oklahoma, Kansas, Nebraska, Arkansas, Missouri, Iowa, Minnesota, Illinois, Wisconsin, and the upper peninsula of Michigan. This area loses part of Texas and gains part of Michigan.

• **San Antonio (Tex.)**—New Mexico and Texas and Louisiana west of the Mississippi River. This area gains part of Texas.

• **Sacramento (Calif.)**—Oregon, Nevada less Clark County, and California north of the northern boundaries of San Luis Obispo, Kern and San Bernardino Counties. There is a slight shift in the boundaries of this area in California and Nevada.

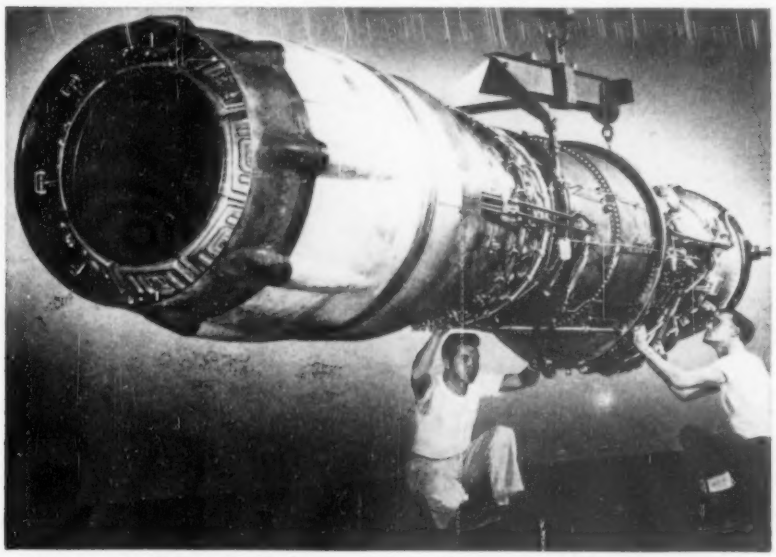
• **San Bernardino (Calif.)**.—Arizona, Clark County, Nevada, and California south of the northern boundaries of San Luis Obispo, Kern and San Bernardino Counties. Again there is a slight shift in the boundaries of this area in California and Nevada.

Two areas remain unchanged: Warner Robins (Ga.) Air Materiel Area, with Virginia, North Carolina, South Carolina, Georgia and Florida east of the Apalachicola River; and Ogden (Utah) Air Materiel Area, with Washington, Idaho, Utah, Montana, Wyoming, Colorado, North Dakota, and South Dakota.

The new Air Procurement District to be established will be at Denver, Colo. It includes Washington, Idaho, Montana, Colorado, Utah, Wyoming, North Dakota and South Dakota.

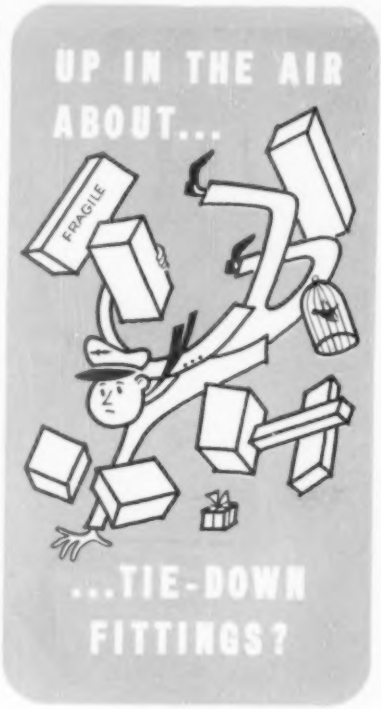
Those Air Procurement Districts, excluding Air Force plant representatives, the areas of which will be changed:

• **San Francisco (Calif.)**—Oregon and



New P&W J57 Features Shorter Afterburner

An afterburner two feet shorter than that used on other Pratt & Whitney J57s is highlight of this J57-P-13 engine, two of which go on the new supersonic McDonnell F-101A Voodoo USAF fighter. The new afterburner (foreground) on the 10,000-lb.-thrust-class twin-spool jet was developed by the company under an Air Force contract.



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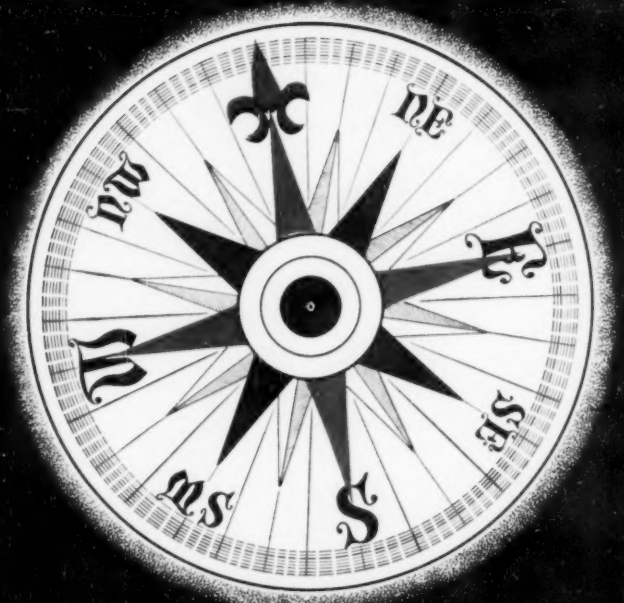

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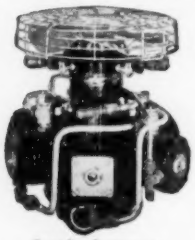

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• **Dallas (Tex.)**—New Mexico, Texas, and Louisiana west of the Mississippi River. This district loses Arkansas and the rest of Louisiana.

• **Milwaukee (Wisc.)**—Wisconsin, Minnesota, and the upper peninsula of Michigan. This district loses part of North Dakota and of South Dakota.

• **St. Louis (Mo.)**—Missouri, Nebraska, Oklahoma, Kansas, Arkansas, and Illinois below the northern boundaries of Case, Adams, Brown, Douglas, Edgar, Macon, Menard, Moultrie and Sangamon Counties. This district loses the states of Wyoming, Montana, and Colorado and gains Arkansas.

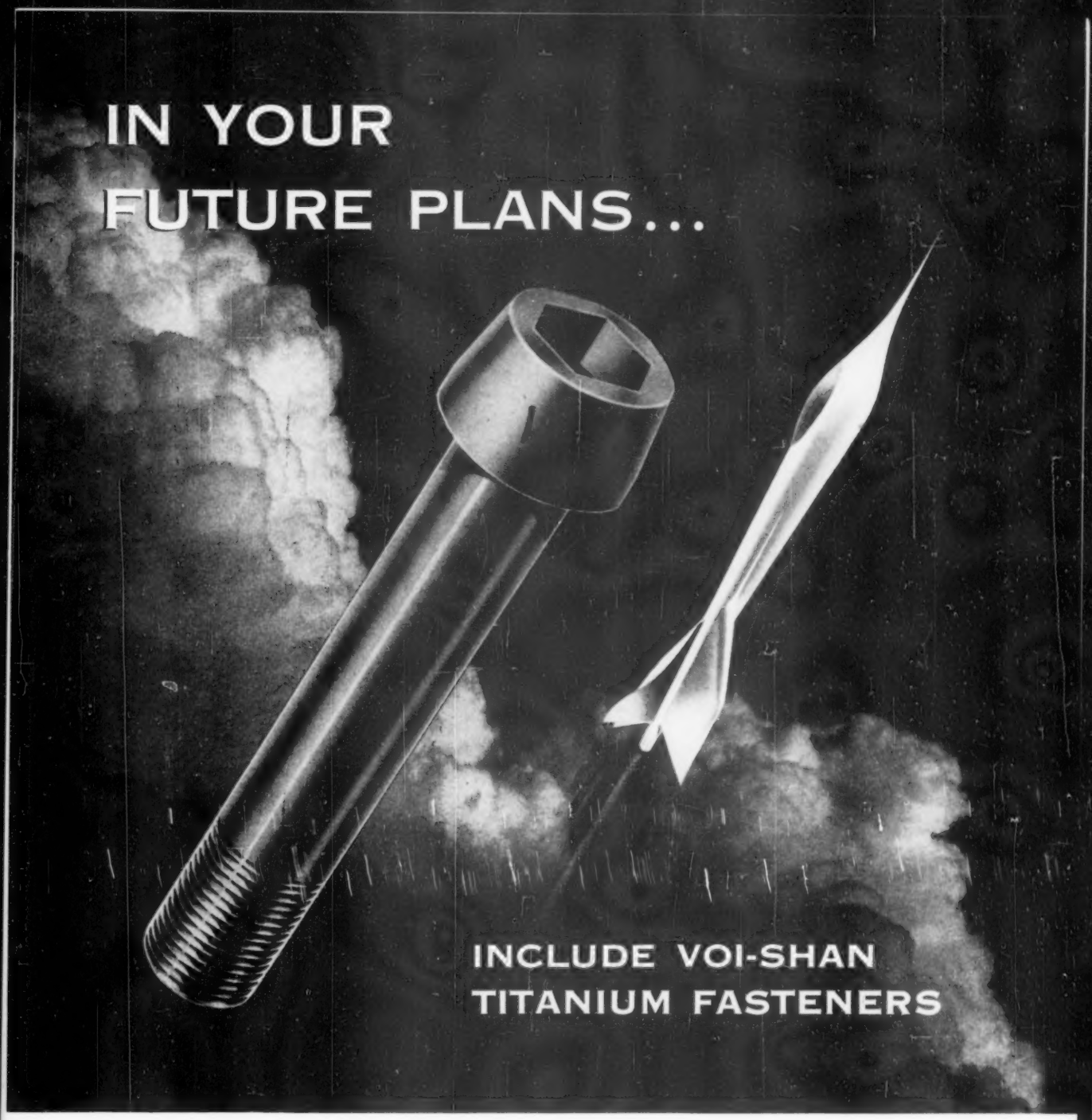
• **Dayton (Ohio)**—Kentucky, Alabama, Tennessee, Mississippi, West Virginia, exclusive of Marshall, Ohio, Brooke and Hancock Counties; Ohio south of Highways 30 and 30S exclusive of cities on those highways, but including Lima, Ohio, to the western boundary of Marion County and that part of Ohio south of the southern boundaries of Marion, Morrow, Knox, Muskingum, Noble and Monroe Counties; Louisiana east of the Mississippi River and Florida west of the Apalachicola River. This district gains part of Louisiana and Florida.

• **Atlanta (Ga.)**—Virginia, North Carolina, South Carolina, Georgia and Florida east of the Apalachicola River. This district loses the rest of Florida.

There are no changes in the geographical boundaries of 12 Air Procure-

Three-Cent Mail by Air

Inauguration of three-cent mail airlift on West Coast Nov. 22 is the subject of this ceremony with Western Air Lines president Terrell C. Drinkwater (left) watching Assistant Postmaster General Norman R. Abrams (center) and Los Angeles Postmaster Otto K. Oleson load the first sack aboard an airliner. The ordinary-mail airlift serves 17 cities on the Pacific Coast.



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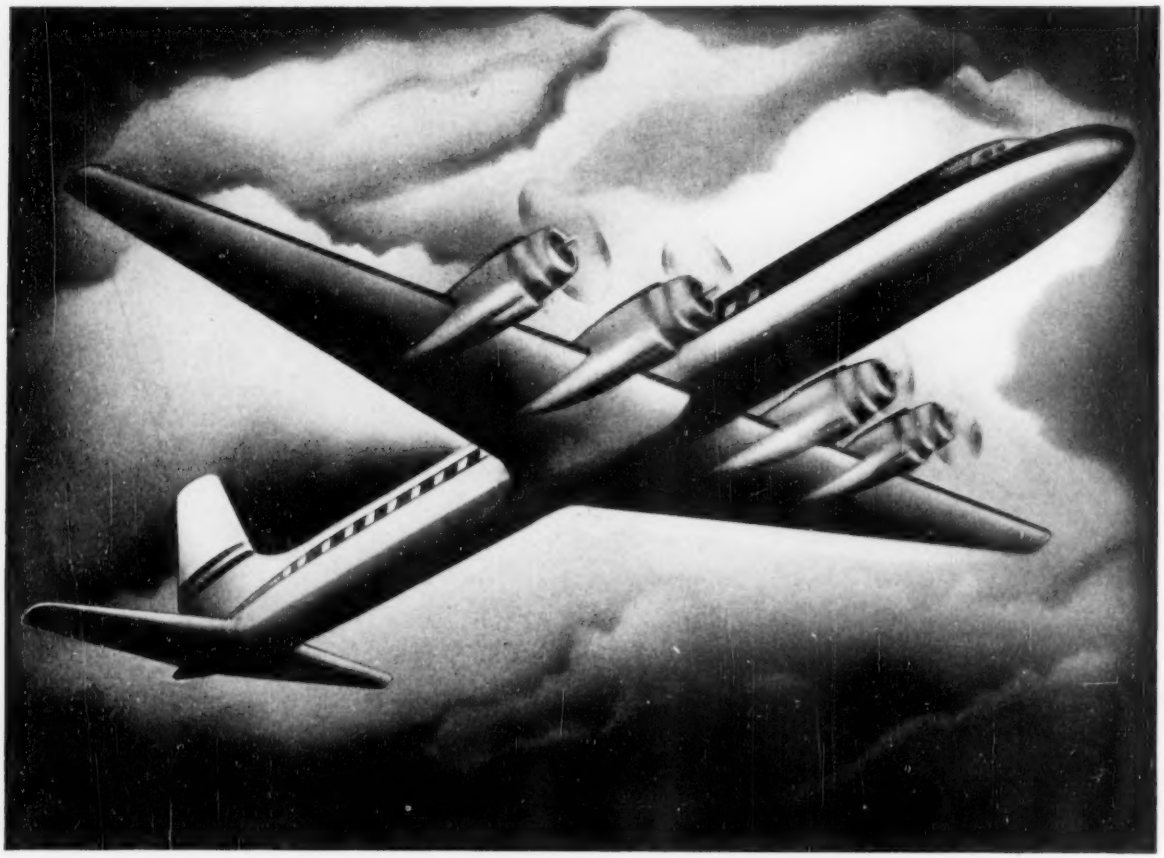

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Capital, TCA Push Viscount Training

Capital Airlines is working with Trans-Canada Air Lines to develop training programs for the turboprop Vickers Viscount transports that both carriers will introduce in North America early next year.

The Canadian and American carriers have sent groups to England for initial training from both Vickers-Armstrongs and Rolls-Royce, maker of the Dart turboprop engines powering the Viscount.

► **Training Underway**—Capital flight and maintenance personnel spent several weeks with the two British companies this fall in a program that ranged from flight training with Vickers at Weybridge to on-the-job training in the Rolls-Royce factory at Derby.

Trans-Canada has maintenance training under way at Winnipeg, and a group of Capital employes are participating in this course. Since TCA entered the turboprop field in advance of Capital, the Canadian program is further along than U. S. airline's.

Trans-Canada is expected to receive its first Viscount by the first of the year. At that time, Capital will send flight personnel to Montreal for training with the Canadian carrier in operation of the aircraft.

► **Capital Program**—Capital plans to have six flight crews trained and ready to fly when its Viscounts are delivered next spring. The airline plans to start service about Apr. 1, 1955. Six crews are considered sufficient to cover the operation of the initial delivery of three aircraft.

Capital will have its own training programs operating after the first of the year, drawing on the experience of personnel trained in England and Canada.

The bulk of the training program will take place at the home base in Washington, although some will be done at various of the airline's line stations.

To expedite servicing of Capital's Viscounts, Vickers-Armstrongs has announced it is setting up a spares store with a 100% provisioning in Alexandria, Va., a short distance from Capital's main base at Washington National Airport. Parts will be sold to CAP on an over-the-counter basis, simplifying the airline's supply system.

Vickers also is establishing an office in Washington for post-delivery servicing of the Viscount.

Aircraft Suppliers Win Tax Writeoffs

International Petroleum & Chemical Exchange, Inc., Lake Charles, La., has won an accelerated tax amortization certificate for aviation alkylate facilities of $6.7 million with 100% allowed, largest amount certificated by the Office of Defense Mobilization from Nov. 4 to Nov. 17.

In addition, ODM granted the firm additional certificates of $2,775,000 with 50% allowed and $125,000 with 35% allowed.

Other certificates:

Somerville Machine & Foundry Co., Somerville, Mass.—aluminum sand castings for military end items, $29,050 certified with 65% allowed.

The Carborundum Co., Niagara Falls, N. Y.—research and development laboratory, $552,668 certified with 55% allowed.

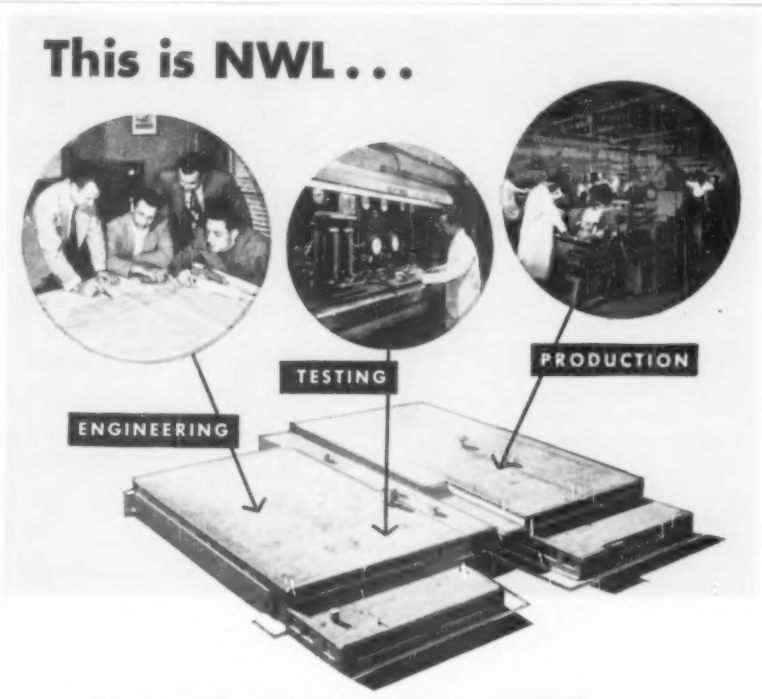
Experimental & Tool Works, Inc., West Springfield, Mass.—aircraft engine parts, $69,598 certified with 45% allowed; $59,067 certified with 70% allowed.

Humble Oil & Refining Co., Baytown, Tex.—aviation alkylate facilities, $236,500 certified with 100% allowed.

Combustion Engineering, Inc., Chattanooga Div., Chattanooga, Tenn.—research and development, $495,099 certified with 55% allowed.

American Non-Gran Bronze Co., Berwyn, Pa.—aircraft parts, $3,022 certified with 70% allowed.

Thomas A. Edison, Inc., West Orange, N. J.—military aircraft components, $30,235 certified with 65% allowed.



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Telling the Market

Four-page bulletin A-634 describes **Dodge Air-Grip Clutch** for power transmission, gives selection data on sizes and air pressure data. Available from Dodge Mfg. Corp., Mishawaka, Ind. . . . **Solid steel, weldless rings** in a variety of cross sections and shapes are described in 12-page bulletin published by Edgewater Steel Co., Box 478, Pittsburgh 30. . . . Application and performance of **Porous metal and plastic** structural and filtering material in aircraft are described in booklet available from Aircraft Porous Media, Inc., Glen Cove, N. Y.

New 44-page Standard Dial Catalog lists **precision-machined and calibrated dials** manufactured by Ackerman Engravers, 458 Broadway, New York 13, N. Y. . . . Electric Indicator Co., Inc., Springdale, Conn., has published 26-page Brochure EI-3A giving quick, comprehensive reference to the company's **Elinco induction and torque motors.** . . . Burndy Insulug Bulletin YAE54 provides latest information on company's tin-plated copper, nylon-insulated, compression-installed **Insulugs and Insulinks.** Write to Burndy Engineering Co., Inc., Norwalk, Conn.

New Publications

Farmers' Bulletin 2062, **How to Spray the Aircraft Way,** is available for 15 cents from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. . . . Rapid progress in fields of gas turbine and jet propulsion has been matched by great increase in literature on the subject. National Bureau of Standards' new **Bibliography of Books and Published Reports on Gas Turbines, Jet Propulsion and Rocket Power Plants** (supplement to NBS Circular 509), brings to December 1953 the bibliography originally published in 1951. Price is 50 cents. Order from GPO.

Desk Aids

Pocket-size **gage selector** is a slide chart giving basic dimensions and other information for ring and plug gages in fractional and numbered sizes. Selector is available on request from Threadwell Tap & Die Co., Greenfield, Mass.

Series of **valve selection charts** gives essential details about more than 80 zero-leakage types developed especially for aircraft and guided missiles by Futurecraft Corp. Write to the company at Dept. A-2, 1717 North Chico Ave., El Monte, Calif.

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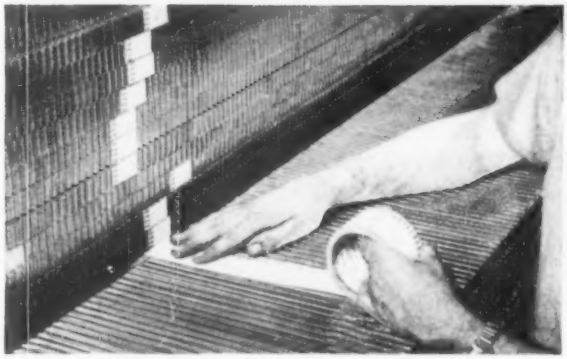
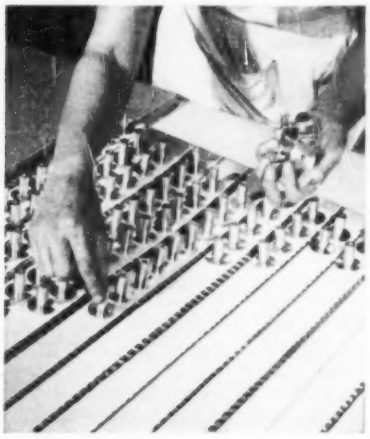
ECONOMY IN PRODUCTION of the Martin Matador, new pilotless bomber, is the result of new techniques in which Permacel Tapes are used for a wide variety of cost and time saving applications.



HONEYCOMB "LUMBER" of aluminum, used in new adhesive bonding technique, is marked by Permacel 725 Printed Tape with part No. identification prior to being sawed into various size panels.



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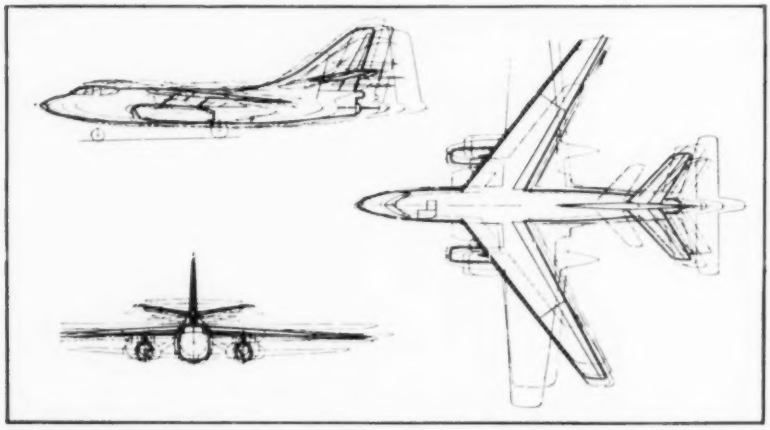
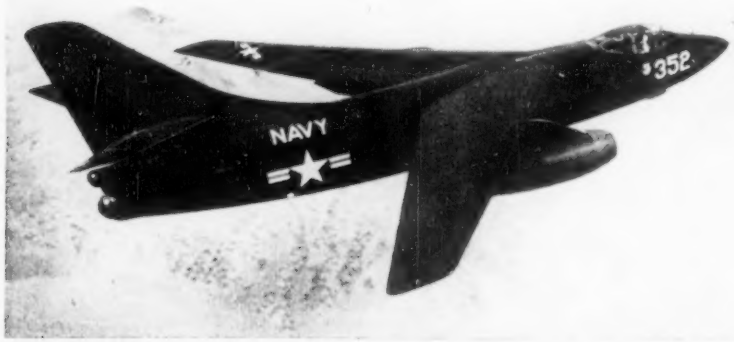
FRONT VIEW OF A3D SKYWARRIOR emphasizes its compactness. Narrow tread of landing gear is noteworthy.

How Douglas Designed the Skywarrior



MULTIPLE THREE-VIEW shows some of the many layouts resulting from almost constantly changing dimensions of the special stores to be carried. These shapes altered required bomb bay size, shape and arrangement, resulting in changed airplane geometry.



A3D ON PROVING FLIGHT. Upper wing surface has been retouched to eliminate details of lateral control system, which incorporates spoilers plus ailerons.

By David A. Anderton

El Segundo, Calif.—Design of the Douglas A3D Skywarrior is an outstanding application of the aircraft growth factor concept.

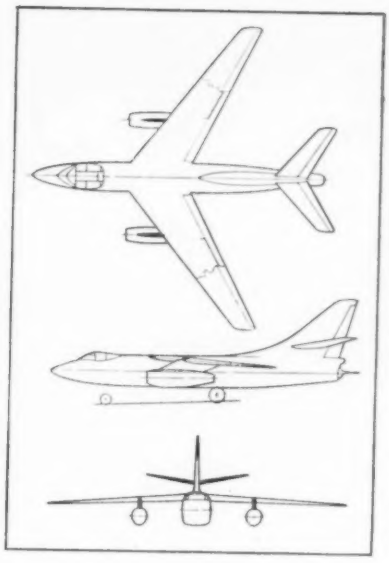
As conceived in 1947, some knowledgeable engineers saw a 200,000-lb. airplane as the only answer to the long-range mission problem the A3D is designed to solve.

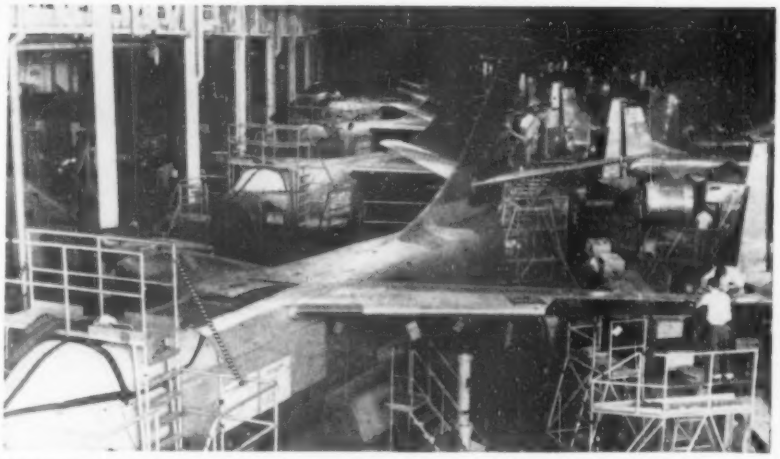
As currently built, the A3D weighs in at 70,000 lb., ready to go. It can operate from Essex-, Midway- or Forrestal-class aircraft carriers at that gross weight. It can speed along near the 700-mph. mark, and can top 40,000 ft. It can carry mines, torpedoes, bombs, fuel or atomic weapons in its bomb bay.

In Air Force markings—and at a higher weight—the plane will serve with USAF squadrons as the B-66 tactical bomber series.

Growth factor for the A3D is about 6.4 pounds per pound; if the turret—to use one example—had not been included, the gross weight could have dropped by 12,500 lb., and smaller engines could have been used.

▶ **Many Firsts**—Douglas El Segundo engineers knew they were tackling a tough problem in the A3D requirements. The plane was to be their first sweptwing airplane designed for military operations around a relatively low load factor and a relatively high aspect ratio. The division's first sweptwing model was the D-558-II Skyrocket, a research airplane with high load factor and low aspect ratio.) This meant structural and aeroelastic problems.





PRODUCTION LINE of Skywarriors parallels AD-5 and AD-6 lines at El Segundo. Early ships off the line are slated individually for special tests or installations at various Navy centers. The A3D has been in production since early 1954.

It was to be the first airplane at El Segundo to have integral fuel tanks; it would require the largest and most complex hydraulic system they had yet built. The division's first windtunnel model for flutter tests was built for the A3D.

It was the Navy's first airplane with a folding vertical tail, as well as folding wings; the bomb bay had to be adaptable for a tremendous variety of internal stores. Mission requirements called for a tail turret armament system, an advanced bombing system and autopilot, and a special fuel system.

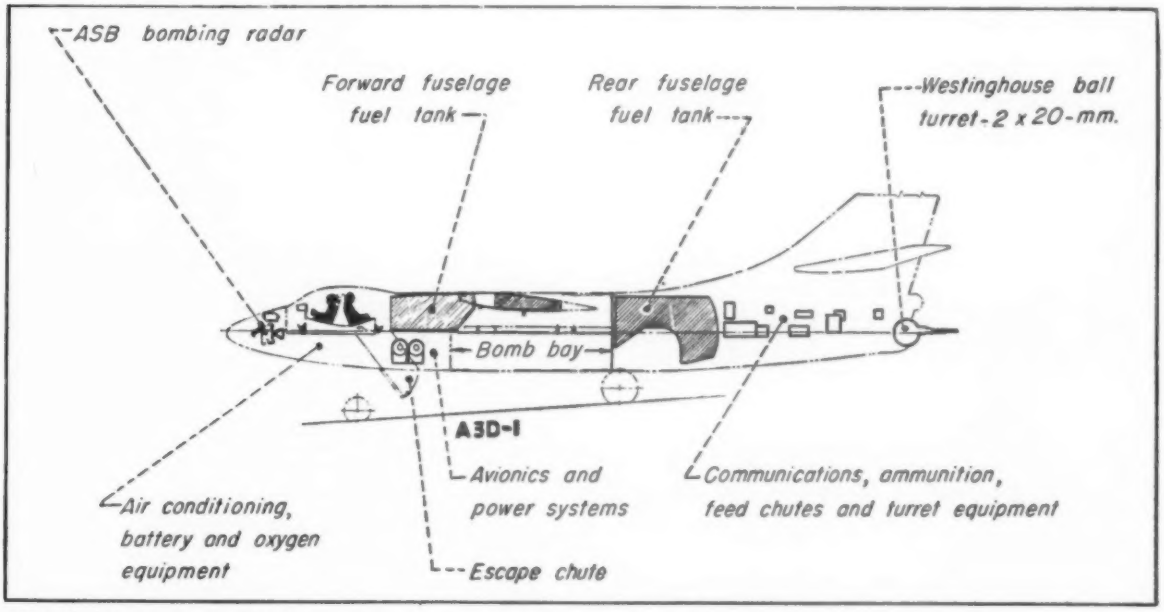
From this formidable list, and the specifications for the mission, grew the Skywarrior. Production models, powered with the Pratt & Whitney J57 turbojet, have been flying for about a year, and the company says that flight test progress indicates the plane will be a highly successful weapon.

► **Basic Layout**—The A3D is a highwing, sweptback, twin-jet airplane with a crew of three. Wings and vertical tail fold for carrier handling and storage. Offensive armament is mounted in a bomb bay of versatile design; defensive armament is a twin-20-mm. tail turret developed by Westinghouse, controlled automatically through an FM antenna located just above the turret.

Wing sweepback is 36 deg. at the quarter-chord; dihedral is zero. Outer wing panels fold overhead; from the hinge line inboard, NACA slotted flaps are mounted. Lateral control is handled with a combination of spoilers and ailerons. Wing leading-edge slats are automatic.

The crew pilot and bombardier sit side-by-side; the navigator/gunner sits back-to-back with the pilot in a pressurized cockpit. Seats are standard; escape from cockpit of the airplane is through a floor chute, pioneered by Douglas engineers in the F3D.

Ahead of the cockpit, most of the nose is taken up by bombing radar antenna and other avionic equipment. Be-


ASB bombing radar
Forward fuselage fuel tank
Rear fuselage fuel tank
Westinghouse ball turret - 2 x 20-mm.
Bomb bay
A3D-1
Avionics and power systems
Communications, ammunition, feed chutes and turret equipment
Air conditioning, battery and oxygen equipment
Escape chute

INBOARD PROFILE OF SKYWARRIOR shows the internal arrangement of the three-man long-range attack bomber.

hind the cockpit is a fuel tank, more avionic gear and the aircraft power systems. Farther aft is the bomb bay, another fuel tank and the main landing gear. Next compartment aft contains some avionics, but is mostly crammed with ammunition and turret system.

► **Rugged Structure**—A walk along the A3D line shows the airplane to be a conventional and simple structure, mostly of 75 ST aluminum alloy.

Complete fuselages are introduced at early stages on the production line; wing and tail units are fabricated separately in conventional jigs.

Basic fuselage layout consists of a nose section, a tail cone and a center section combining wing attachment and bomb bay. Two rugged keels run from nose to tail, forming the sides of the bomb bay and taking catapult and arresting-gear loads.

Wing structure approximates a torsion box, but is designed as a two-spar assembly with very thin skin between the spars. Flutter requirements, rather than wing bending loads, dictated the choice of skin thickness. From fuselage centerline to about a quarter of the distance along the outer panels, the skin thickness is a constant $\frac{3}{8}$ in.

► **Aerodynamics**—Much information on the aerodynamic design of the A3D was told by project engineer Harry Nichols to a recent meeting of the Los Angeles aircraft section of the Society of Automotive Engineers.[1]

Nichols said that the airplane characteristics seemed to be highly satisfactory because of the "happy combination" of features selected. The wing aspect ratio of 6.75 was a compromise choice dictated by several factors. Range considerations were the first influence, but there had to be compromises with aerodynamic pitch-up at high speeds and wing flutter problems. As a result, the chosen aspect ratio is higher than most Navy airplanes, lower than most USAF long-range craft.

► **Growth Factor vs. Aspect Ratio**—Earlier this fall, Dr. William F. Ballhaus, then working in the preliminary design section at El Segundo on the A3D, but now chief engineer of Northrop Aircraft, Inc., told an SAE audience at the National Aeronautic meeting about the specific interaction of the growth factor concept and aspect ratio.

Ballhaus said that at one stage the aerodynamicists wanted to get more range out of the A3D by increasing the aspect ratio a little. Some calculations based on the growth factor showed that the range actually would be decreased if the aspect ratio were to be increased.

Somebody suggested that the aspect ratio be decreased instead; growth factor considerations showed that enough weight would be saved to give a final

[1] "Design Features of the Douglas A3D Skywarrior."

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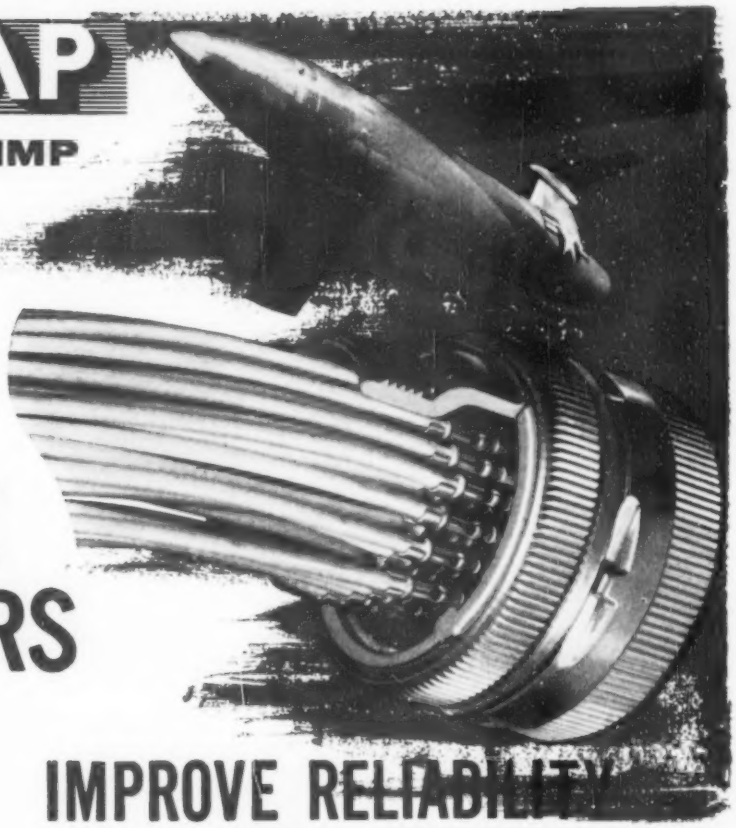

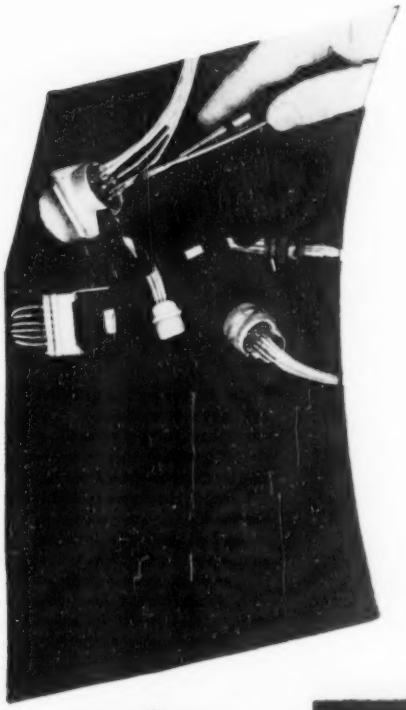

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increase in the range. This, Ballhaus said, was the solution adopted.

► **Thickness and Sweep**—The wing of the A3D tapers in thickness from 10% at the root to 8¼% at the tip; Nichols said this represented a compromise between drag, structural weight and control characteristics.

Wing sweep is 36 deg., measured at the quarter-chord. At the time of the design, this seemed like the best number for satisfactory lowspeed and high-speed flight control and stability. Nichols said that if El Segundo engineers were to second-guess the sweep angle today, the best value would still be close to 36 deg., and in no case more than 40 deg.

Wing dihedral was set at zero degrees, said Nichols. (The airplane three-view looks as if negative dihedral were used, but that is because of the wing incidence.) Lateral stability considerations at the time of design showed this to be the best compromise angle. Nichols said that now they might possibly choose a negative angle of minus one degree, based on current knowledge, to improve carrier approach stability, but present lowspeed stability is satisfactory.

► **Pods Again**—Engine nacelles housing the Pratt & Whitney J57s are supported as low as they can be and still give adequate ground clearance. Strong arguments for their location include the ease of servicing, and the fact that the engines could be handled by standard Navy torpedo lift trucks with special engine support adapters.

Position for minimum drag was found in windtunnel tests; it required that the nacelles be raised so that their top edge would coincide with the wing upper surface. But moving the nacelles up would aggrevate the servicing problem, and would interfere with the present flap, said Nichols.

He pointed out that another very important consideration was to minimize airplane changes if an engine model change were to be required. This did happen; engines were changed between experimental (Westinghouse J40) and the production (P&W J57) airplanes.

► **Escape Chute**—The bailout chute in the A3D feeds the crew out of the belly, down and aft. The door in the belly is power-operated with cartridge-fired cylinders; the pressure will hold the door full open against the airstream at design limit speed of the airplane. The door acts as a windscreen as the crew bails out. The upper door of the chute is actually the cockpit floor; it is pulled down by the mechanism that operates the lower door. There are no projections to snag clothing or limbs inside the chute.

This choice of escape technique was not made lightly. Use of separate ejec-

New Italian Rocket

First picture of new Italian liquid-propellant rocket developed by A. C. Robotti, a Turin engineer, shows the simple layout of the missile. Robotti says the rocket is powered by a liquid bi-propellant combination and that it is capable of supersonic speeds. Further details are restricted, he says. Size and geometry hint at test vehicle use, rather than any tactical capability of the missile.

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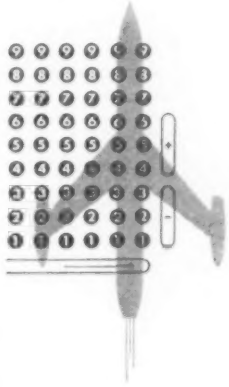

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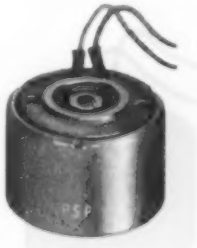

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The Original Process for mass producing Precision Investment cast blades, vanes, and buckets for Aircraft Engines.

tion seats would have meant blowing off the canopy, which Nichols said would have caused a "serious enclosure design problem." The direct weight saving, not counting the growth factor, was 550 lb.

Nichols noted that if ejector seats had been used, the gunner would have had to face forward, which means moving the rear cockpit bulkhead aft and reducing the fuel quantity in the forward fuselage tank.

▶**Power Units**—In the A3D, aircraft auxiliary power for the electrical and hydraulic systems comes from high-pressure air turbine units located in the fuselage. Weight saved was 125 lb.; it came from elimination of ducts, piping and wiring in the wings, fuselage and nacelles.

All the relays, battery, hydraulic valves and reservoirs are located within a radius of about three feet from the drive units. Nichols said this is expected to result in less battle damage than if the units were strung out. There is added combat protection provided by flak curtains shielding the units.

Most of the armament and stores carried in the bomb bay attach to a removable platform located about halfway up the height of the bay. Bombs are carried on individual ejector racks to guarantee positive separation. Just ahead of the bomb bay on the fuselage belly, there is an anti-buffet rake, automatically lowered when the doors are opened. This rake has reduced the open-bay buffet remarkably, Nichols said.

▶**Extra Thrust**—Rato bottles—12 of them—are used for carrier takeoffs at full gross weight, where catapulting is not desirable. There is enough extra thrust available to give spectacular takeoff performance; for five seconds, the big plane could fly vertically on Rato plus engine thrust. After takeoff, the bottles are jettisoned.

Fuel for the J57 engines is carried in four locations—two self-sealing fuselage tanks and two integral wing tanks running from the fuselage intersection to the wing fold line.

This distribution of fuel weight forced Douglas engineers to look into a means of controlling the center of gravity position. This is done with an electrically controlled transfer valve between forward and rear fuselage tanks. The operation is controlled from a preset schedule of tank level; fuel quantity probes in both tanks sense the fuel levels and start or stop the transfer.

In addition, the pilot can elect to transfer fuel from the wing tanks to the fuselage tanks; the fuel is pushed through by air pressure from engine air bleed.

There is a dividend paid by this system in the reduction of fuel boiloff. The pilot waits until the wing fuel is

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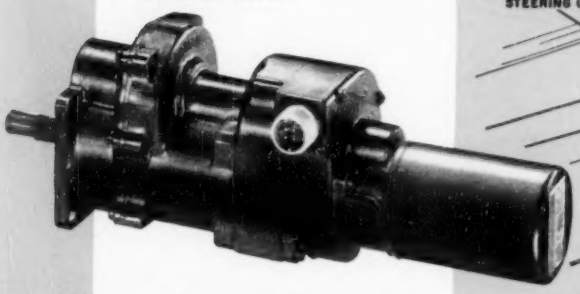
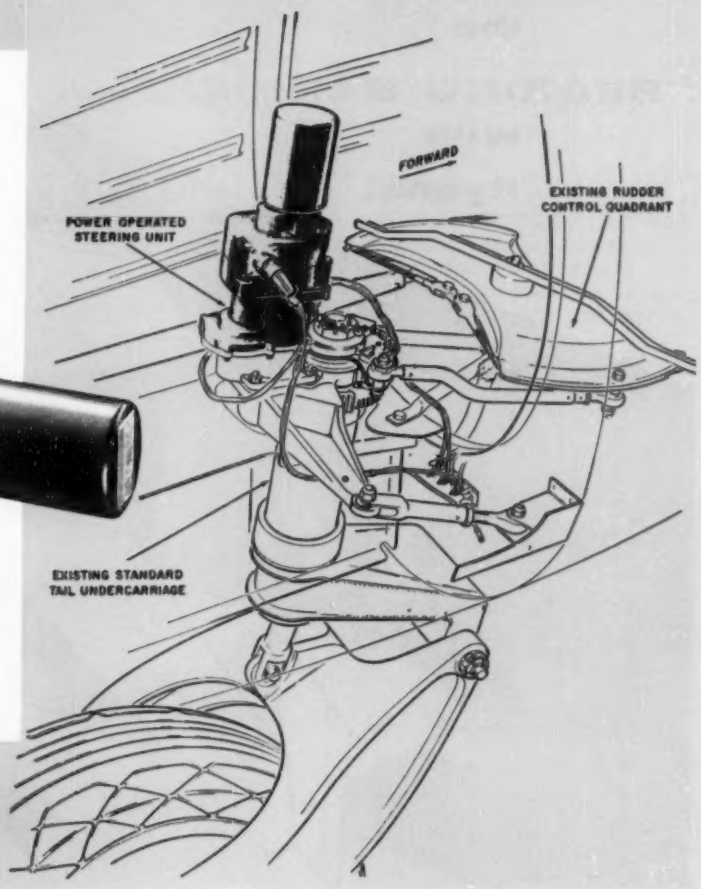
R-652 actuates the tailwheel power steering installation in De Havilland of Canada's DHC-3 Otter



The R-652 operates at 10 rpm at maximum operating torque of 1000 lb. in. Overload slip clutch adjusted to slip at 1200 lb. in. Magnetic clutch will hold maximum load with 17 volts min. applied. The R-652 weighs 8.15 lb.



Drawing courtesy of De Havilland Aircraft of Canada, Ltd.

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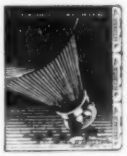

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cooled by transfer through the skin to the outside air; he then dumps this cooled fuel into the fuselage tanks and lowers their temperature. The drop in temperature means less boiloff of the lighter components of the fuel at altitude.

Douglas engineers compared the system with that of separate refrigeration for the fuel, and found a large weight saving for the A3D system. Tank pressure is carried at 2 psi. to reduce boiloff further.

▶**Control Systems**—Hydraulically powered controls are standard for all three axes on the A3D. Nichols said that El Segundo philosophy is to guarantee manual operation in the event of power-control failure; to that end, elevator and rudder boost ratios are low enough so that a pilot can maintain adequate control manually. For the ailerons that is not so easy, and so there are two independent power systems; normally, they give the equivalent of about a 40-to-one boost, although the system is actually irreversible.

With one system out, power output goes down by half, which can still maintain satisfactory lateral control. To top this, there is a manual system with a two-to-one mechanical advantage change; field landings have proven that this combination gives satisfactory aileron control.

Normal operating systems for landing gear and flaps are hydraulic, but both have emergency pneumatic systems.

Spoilers are independent of the ailerons, and produce about twice the aileron rate of roll at high speed because they cause no adverse wing twisting. Spoiler motion is sensed from the ailerons; the control system is independent from the ailerons and does not

"Whoops, there goes the old seat-belt sign, George!"

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Type Number	Rated Voltage		Max. Power Input Total (Watts)	No Load Speed (RPM)	Stall Torque (oz. inches)	Torque to Inertia Ratio (Radians per Sec.²)	Weight (oz.)
	Phase 1	Phase 2					
LOW INERTIA MOTORS							
CK-1018-7	18	18	5	10,000	0.13	13,000	1.6
CK-1022-13	115	115/57.5	12	4,800	1.45	33,800	8.0
CK-1027-14	115	115/57.5	7	6,200	0.63	41,500	4.5
CK-1028-16	26	26	6	10,000	0.28	13,000	1.6
CK-1031-18	26	55	9	6,400	0.35	10,000	2.2
CK-2006-1	64	64	30	7,200	2.6	70,000	10.0
CK-3000-1	110	220	80	3,700	14.0	3,750	30.0
MOTOR GENERATORS							
FV-101-5	26	26	9.5	10,000	0.28	10,000	2.9
FV-2001-2	115	115	30	6,600	3.0	70,000	12.6
FV-3000-1	110	220	80	3,700	14.0	3,750	30.0
X-1214382	26	26	9.7	6,000	2.6	21,000	5.5

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feed back any load into the control column. The spoilers do not operate when the ailerons are on the "manual" system.

▶**Flutter Problems**—Douglas engineers knew they were going to have some kind of aeroelastic problems with the A3D, so early in the game they got into a deep study of flutter. A very complete survey of the program was presented by four El Segundo engineers at the recent SAE national aeronautic meeting; the material appearing here is adapted from that paper.[2]

The preliminary flutter analysis was done on analog computer at the California Institute of Technology. Early in the program, the horrible happened. The flutter speed was below the design speed of the airplane. It was a problem of the basic wing, and showed up with or without nacelles on.

Three major changes were made as a result: Nacelles were relocated somewhat outboard and forward of the original location, the wing torsional rigidity was increased, and the pod-pylon rolling rigidity was increased.

Parallel with the analog program, Douglas engineers designed and built a flutter model, which was not completed until after the prototype design had been frozen (with changes incorporated from the flutter analysis).

Windtunnel tests were made in three phases. A wing alone was tested in the Douglas lowspeed tunnel, primarily as a matter of convenience. The full model was tested in the 10-ft. tunnel at low speeds in the Guggenheim Aeronautical Laboratory of Cal Tech. Variable-density tunnel tests were done in the Southern California Cooperative Windtunnel.

▶**Test Results**—The first model tests confirmed the computer results for wing alone; but with prototype nacelles on, flutter occurred at a speed well within the airplane speed range. "This was a disquieting event," said one of the engineers, because the computer hadn't predicted this.

Stiffer pod-pylons improved the situation, but didn't complete the job. But other developments were more favorable. The flutter developed slowly and was not wildly divergent. Simulation of fuel weight raised the point of neutral flutter stability beyond the design speed or stopped the inner-panel torsional flutter completely. Limit speed at altitude could be reached without running the risk of flutter.

Production nacelles and engines were to be different, and the combination

[2] "A Comparison of Experimental and Analytical Flutter Characteristics for a Sweptwing Jet Bomber"—presented by D. G. Dill, M. D. Lamoree, R. H. Stringham and F. W. Melching, Douglas El Segundo engineers, at the National Aeronautics Meeting of the Society of Automotive Engineers.

FIRST PAN AM SUPER STRATOCRUISER to use the new G-E turbosupercharger is the "Clipper Mayflower." Improved turbo allows cowl flaps above mechanic's head to be drawn in closer to the engine to reduce drag.

NEW G-E turbosupercharger kit boosts Stratocruiser's speed, range and payload

Now . . . at no increase in operating cost, Pan American's Boeing Super Stratocruiser fleet can make daily, non-stop flights from New York to Europe.

General Electric's new CH-10 modification kit contains all parts needed to install *a slightly larger turbine wheel* to replace the one now used in Boeing Stratocruiser turbos. This new wheel reduces back-pressure on R-4360 engines. It lowers engine cylinder temperatures. By reducing cooling air requirements, it permits drawing the cowl flaps closer to the engines to reduce drag, increase flight speed.

On Pan American's forthcoming Super Stratocruiser flights from New York to London and Paris, the CH-10 turbosupercharger helps make possible a 95-mile range increase; a five-knot speed increase; plus several hundred extra pounds of load capacity. Now it is possible, also, for Super Stratocruiser flights to bypass the traditional West/East refueling stop at Gander, Newfoundland—*a stop all other un-modified Stratocruisers continue to make!*

For further application data on the CH-10 modification kit, contact a G-E Aircraft Specialist via your nearest G-E Apparatus Sales Office. If you wish, write to *Section 231-2, General Electric Company, Schenectady 5, N. Y.*

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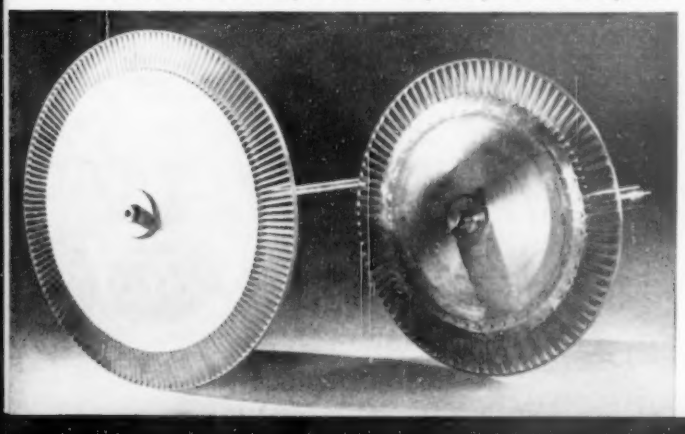
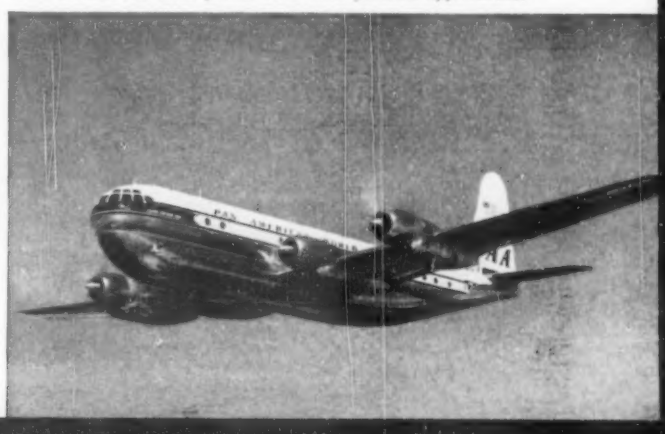
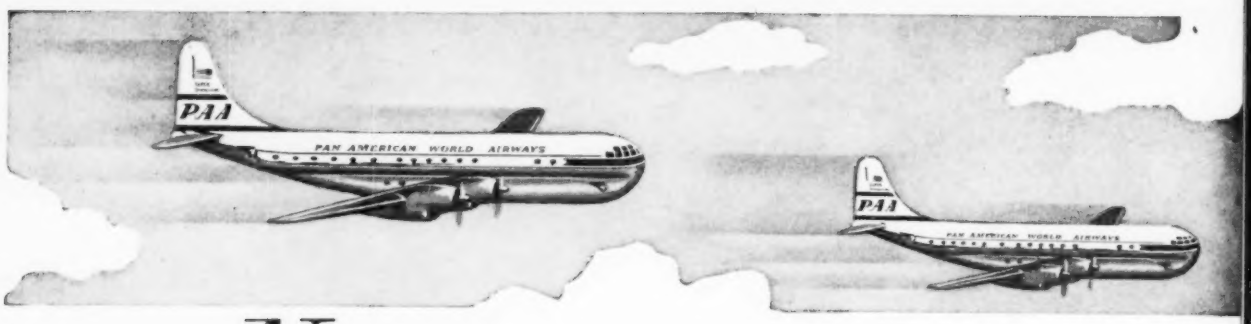
GENERAL ELECTRIC

LARGER TURBINE WHEEL (left) is key component in General Electric modification kit. It's easy to install—only four parts must be replaced.



TRANS-ATLANTIC PAN AM FLEET will be fitted with CH-10's by Dec. 15. U.S. Air Force planes offer other possible applications.





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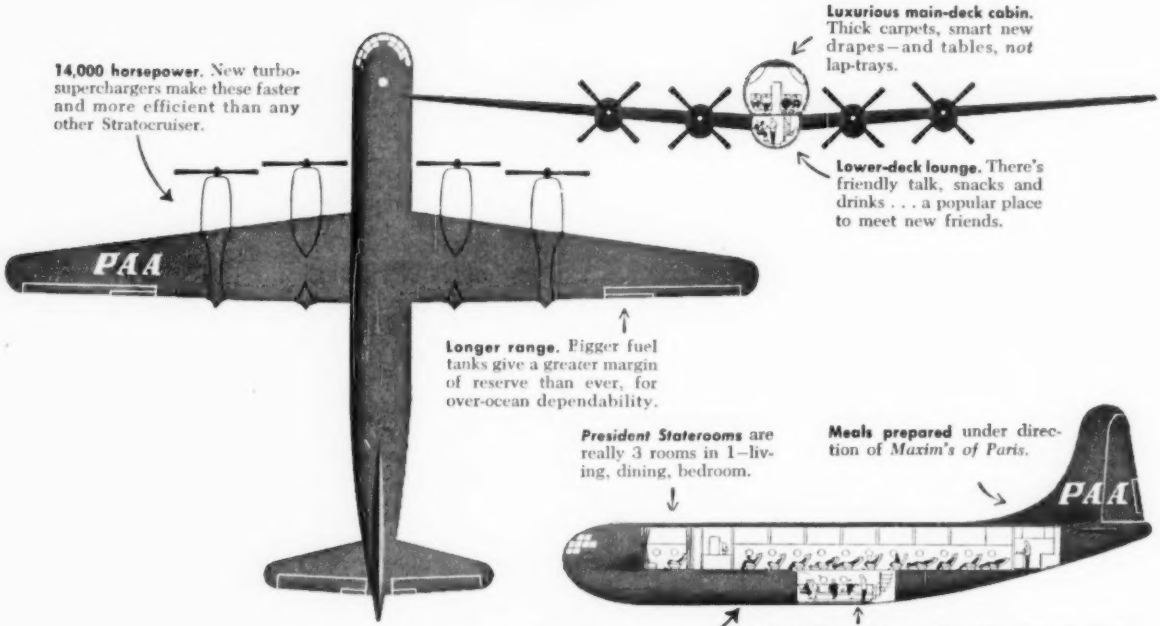

14,000 horsepower. New turbo-superchargers make these faster and more efficient than any other Stratocruiser.

Luxurious main-deck cabin. Thick carpets, smart new drapes—and tables, *not* lap-trays.

Lower-deck lounge. There's friendly talk, snacks and drinks . . . a popular place to meet new friends.

Longer range. Bigger fuel tanks give a greater margin of reserve than ever, for over-ocean dependability.

President Staterooms are really 3 rooms in 1—living, dining, bedroom.

Meals prepared under direction of *Maxim's of Paris.*

Everybody sleeps in a Sleeperette service easy chair or in a berth that's bigger than on a train!

Super Stratocruisers offer "downstairs" service. There's room to walk around on these giant airliners! Come down the circular staircase anytime to the lower-deck lounge for extra relaxation.

The Super Stratocruisers are exclusive with

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LONDON AT NO EXTRA COST

most comfortable, over-ocean airliners

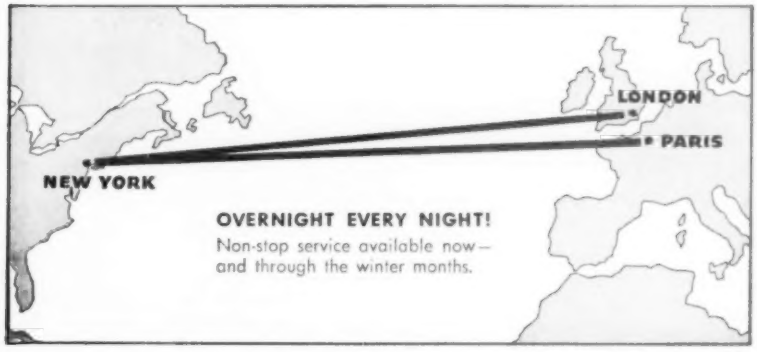
Nightly to LONDON! Five a week to PARIS!

● By December 15, Pan American's new fleet of *Super* Stratocruisers will be flying *daily* to Europe on regular NON-STOP schedules.

These great airliners are superpowered. Each is equipped with 4 new turbo-superchargers—new propellers—more fuel capacity for increased over-ocean dependability.

This means you can now enjoy quiet, restful sleep as you fly on, high above the weather, to PARIS OR LONDON. You'll land refreshed, ready for work or fun, in the morning . . . because you will have crossed the Atlantic NON-STOP!

An all-sleeper service. Stretch out your feet as far as you can—yours can't touch the seat in front! Yours reclines to *bed-length!* That's Sleeperette* service . . . another Pan Am exclusive. If you choose, reserve a berth—foam-soft—at slight extra cost.



Superb "President" service. Cocktails, or your favorite refreshment, appear tinkling at your elbow. With hors d'oeuvres, of course. Then, somehow, you sense Paris is near. Meals prepared by renowned *Maxim's of Paris* are being served! Whether it's *Breast of Chicken Veronique—Filet Mignon Rossini*—or some other specialty—*Maxim's* gives it a unique touch of excitement and romance.

Staterooms available. Want to be alone? You can be, with your wife or business companion, in the seclusion of a *President Stateroom*, designed by Dreyfuss. Lounge chairs, both upper and lower berths—retire when it suits you best—generous shelf and closet space, private wash basin, private bar, special service. Just $125 extra for double occupancy.

Choice of service. Ten flights each week are by regular, first-class *President* service . . . two a week are by the famous *President Special*, a deluxe, extra-fare flight. You may use the popular Pan Am "Pay-Later" Plan to finance your trip, if you wish.

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Experienced Airline.

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Another "plus" for America's most luxurious skyliners

Something new has been added to the name of Pan American World Airway's Stratocruisers. It is the designation "Super," which the airline is applying to its Boeing Stratocruisers after installing new turbosuperchargers, new propellers and extra fuel tanks. These Super Stratocruisers will be able to handle Pan American's daily flights to Europe on regular nonstop schedules.

From the very first, the traveling public has shown a marked preference for the big, quiet, roomy Boeings. The lower-deck lounge, an exclusive feature, affords a welcome roam-around break, particularly on long-distance flights. And the greater quiet and roomier seats are other repeat-business advantages.

During their years of service on domestic and global routes, Boeing Stratocruisers have carried over two and three-quarter million passengers, and have flown more than 150,000,000 miles in commercial service. They've completed almost 25,000 trans-ocean crossings. In addition to this vast background of commercial flying, the Stratocruisers' military counterparts, the C-97s, have for years operated throughout the world as cargo, personnel and hospital ships for the Military Air Transport Service, and as tanker-transports for Strategic Air Command.

Pan American's trans-Pacific Stratocruisers fly the longest non-stop over-water leg of any U. S. certified commercial airline, the 3,846-mile aerial voyage from Tokyo to Honolulu. On this route, flying the high-altitude jet streams, the Stratocruiser logs the fastest block-to-block speed currently scheduled for any airplane, 344 miles per hour.

Now, Pan American's newly modified Super Stratocruisers will be able to turn in even more impressive performances.

BOEING

was stabilizing and permitted flight at all design speeds and altitudes.

▶ **Some History**—Navy Bureau of Aeronautics first started talking in 1947 about the airplane concept that was to lead to the Skywarrior. The first Navy weight estimates started at 62,000 lb. and went on up to 200,000 lb. With more detail studies out of the way, the Navy trimmed its sails to a 130,000-lb. airplane. Later they whittled that figure down to 100,000 lb.

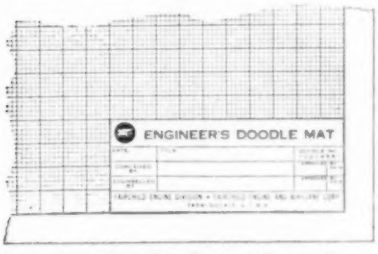
That size pegged it for the super-carriers only; but Ed Heinemann, hard-headed chief engineer at El Segundo, decided to beat that figure by a considerable margin so that the plane could operate off tangible carriers, instead of being limited to some future design.

Heinemann's skepticism paid off; less than one year after the Navy told Douglas to go ahead with the A3D, Congress lopped the super-carrier out of the budget. Now reinstated as the Forrestal class, the super-carrier will not have any monopoly on the A3D; the plane can operate off modified Essex-class and the Midway-class carriers as well.

THRUST & DRAG

Tired of making lunchtime sketches on paper napkins and placemats? The solution was found by Fairchild Engine Division, just in time for the recent SAE national aeronautic meeting.

It's an engineer's doodle mat, placemat size, with a 7x12-in. grid and title block printed in light green. Title block



has room for the date, title, and approvals; it provides one line labeled "conceived by" and a second labeled "counselled by," as you can see by the reproduction above.

Now, thanks to Fairchild, you can eat your lunch and make drawings or graphs to scale at the same time.

I predict this mat will eventually replace the back of the envelope, the paper napkin, the newspaper margin on which most of our leading aircraft have first seen the light of day.

* * *

Complexity, the arch-foe of the aircraft designer, has begun to bother the automotive people. They don't realize it yet, perhaps, because the first

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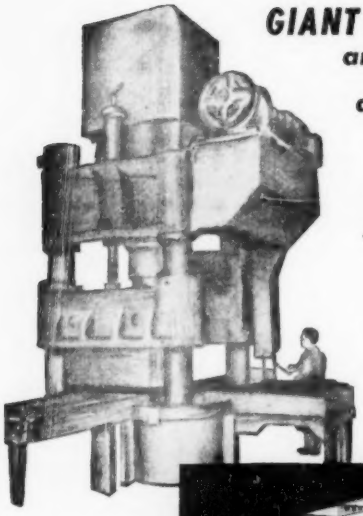

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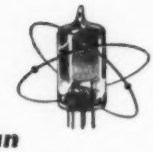
and tiny tubes . . .
all a part of Kaman



The production of Kaman helicopters requires large plant facilities, an impressive inventory of machine tools and equipment . . . and men. From technical men devoted to the research, design and development of aerodynamic, mechanical, electronic, and electro-mechanical devices and systems to production craftsmen skilled in the art of metal working. All are part of Kaman, and each helps explain the universal acceptance of Kaman Performance. Booklet on request.

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SERVICE STEEL • DETROIT, MICHIGAN

ads for a 1955 model praise a more-complex mechanism.

You know about hydraulic drives? You know how simple it is for any mechanic (backed with the resources of any large machine shop) to maintain and overhaul said drives?

No more. Most recently, this particular 1955 car has got variable-pitch blades on the turbines of its transmission. Is the next year's model to feature variable inlet guide vanes?

Let this column be the first to sound the call for a return to a design philosophy of less complexity, of design ingenuity, of a stripped-down automobile. I don't need all those instruments; just give me a couple of warning lights and a speedometer. Strip off all the extra chrome and the seven controls for the air-conditioning unit and the powered seats.

Then we'll have a car that can beat those foreign models from a standing start. —DAA

NEA Develops New Landing Lights

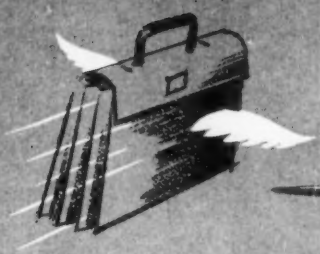
Inexpensive, high-intensity condenser discharge lights which give better visual ground reference to pilots making instrument approaches than conventional landing lights have been developed by Northeast Airlines and have been approved by the Civil Aeronautics Administration, according to NEA.

The Northeast system uses two high-intensity condenser discharge lights, spaced 150 feet apart at the approach end of a runway. They are focused on a point on the middle marker which is at an indicated altitude of 300 ft. At this spot, the pilot sees both lights at maximum intensity. Lens characteristics of the lights are such that as the plane approaches the runway threshold the intensity diminishes so as not to blind the pilot during the critical flareout period prior to landing.

NEA says that during test flights conducted at Nantucket Island (chosen because of its frequent bad weather which allowed tests to be completed rapidly) the lights could be seen through fog "for substantial distances, indicating that their penetration power is sufficient to give visual aid although the aircraft is still on instruments."

Installation is inexpensive enough to allow the lights to be installed at small airports where cost of more elaborate bad-weather lighting equipment would be prohibitively high, NEA says.

Experimental and development work was accomplished under the direction of F. C. Barker, director of communications for Northeast, and K. J. Germeshausen of Edgerton, Germeshausen and Grier.



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Dependable performance, advanced design and modern engineering techniques are incorporated in these new twin engine executive craft by Aero, Cessna and Piper . . . Providing the luxurious appointments, up-to-date conveniences and factors of speed and safety demanded by busy men in these busy times.

Hop-scotching around the country on tight business schedules requires fast maintenance—quick access to vital plane components . . . Aero, Cessna and Piper use quarter-turn Camloc fasteners on executive craft to assure speed of operation, versatility in design and positive locking action.

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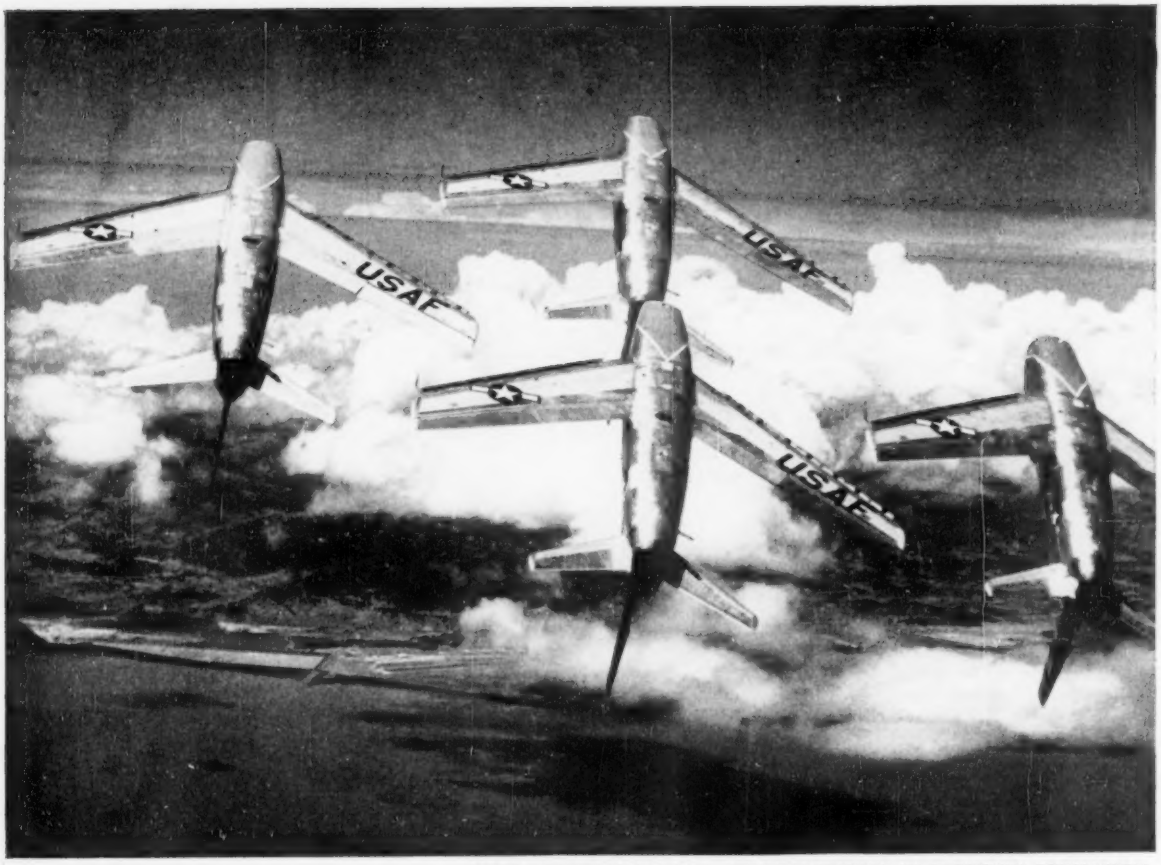

NORTH AMERICAN F-86-D JET INTERCEPTORS IN PRECISION FORMATION.

TITANIUM...performance-proved in the F-86-D

REM-CRU titanium has been used for vital parts of North American's F-86-D jet interceptor since its maiden flight in 1949 . . . as it has in most other advanced-type aircraft.

For REM-CRU, largest producer of titanium, led in the development of titanium alloys for aircraft applications. And manufacturers depend upon REM-CRU titanium alloy grades C-110M and C-130AM for primary structural fuselage frames and wing spar fittings . . . as well as for other vital parts of modern high-performance aircraft.

Now, REM-CRU's greatly expanded facilities insure *prompt* delivery of sheet, strip, plate, bars, wire, tubing and forgings . . . in a wide variety of sizes, shapes and grades—including new REM-CRU high-strength, weldable alloys. REM-CRU's engineering staff is always ready to help with the application or fabrication of titanium.

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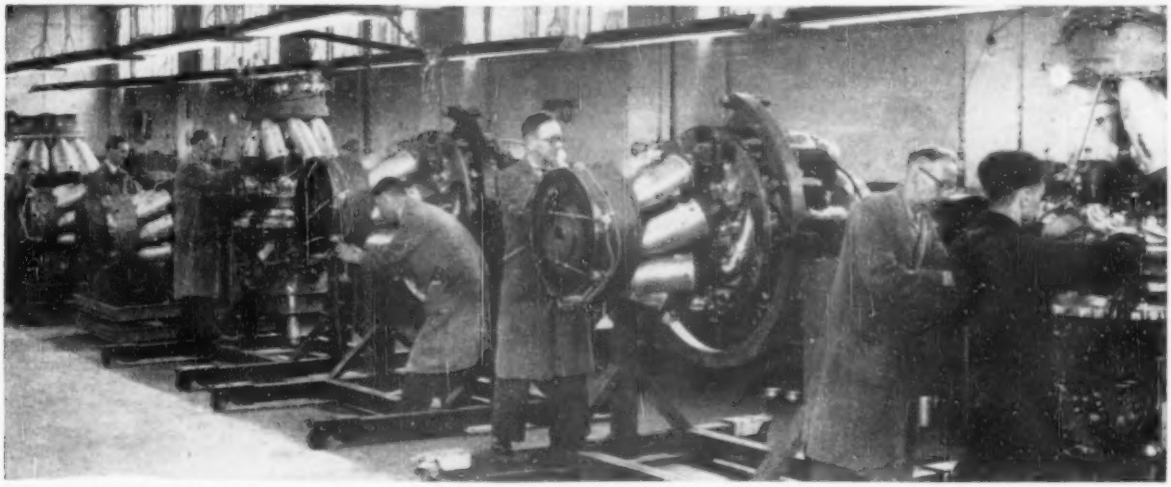


DART TURBOPROP ENGINES on dressing line at Rolls-Royce Derby plant. Designed from scratch as a commercial engine . . .

Dart Spearheads Rolls-Royce Drive

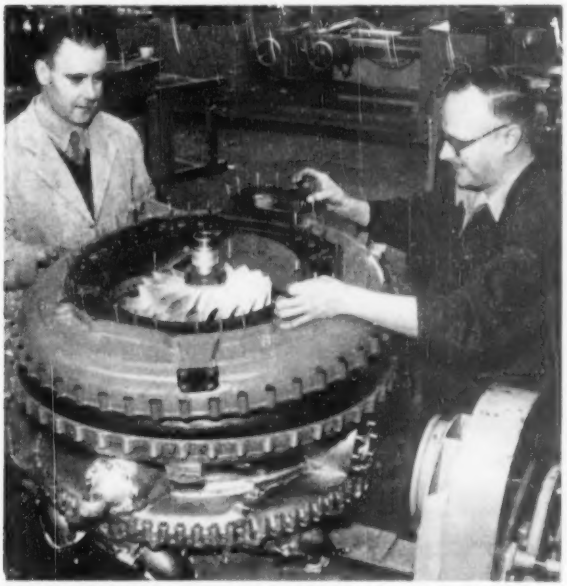
By Robert Hotz

Derby, England—Rolls-Royce, Ltd., is developing a strong challenge to the dominance of American engine manufacturers in the international airline market. Spearhead of the Rolls drive in the commercial gas turbine market is the Dart turboprop, which has already accumulated more than 250,000 hr. of flying in regular airline service.

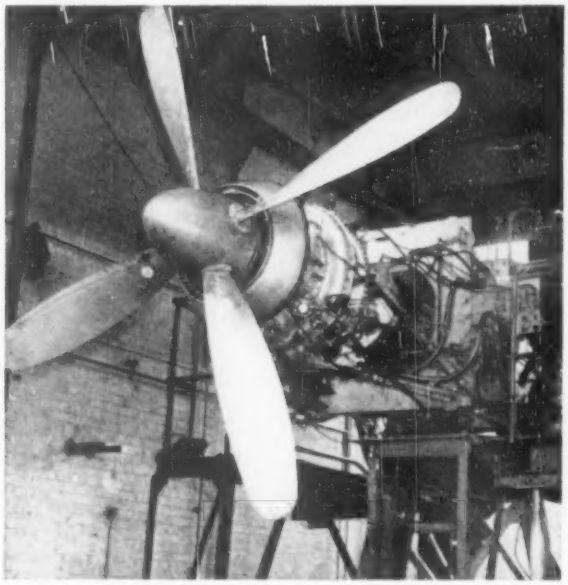
The Dart is followed by the R.B.109 split compressor turboprop aimed at about 4,000 shaft horsepower and an attractive fuel consumption rate. Rolls also has developed the Conway by-pass turbojet, scheduled to power the Vickers V-1000 multi-jet transport and being considered by other airframe manufacturers on both sides of the Atlantic for further transport use.

► **Turboprop Favor**—Both the Dart and the R.B.109 have stirred more than academic interest among U.S. airlines and airframe manufacturers where the current future equipment trend is running strongly in favor of turboprop over turbojet powerplants for upcoming airliners.

The Dart is now in regular airliner service powering the Vickers Viscounts with British European Airways, Aer Lingus and Air France. It will make its American debut this winter with delivery of the first Viscount to Trans-Canada Air Lines, and during 1955 will become the first foreign engine to operate with a U.S. domestic airline, following initial Viscount deliveries to



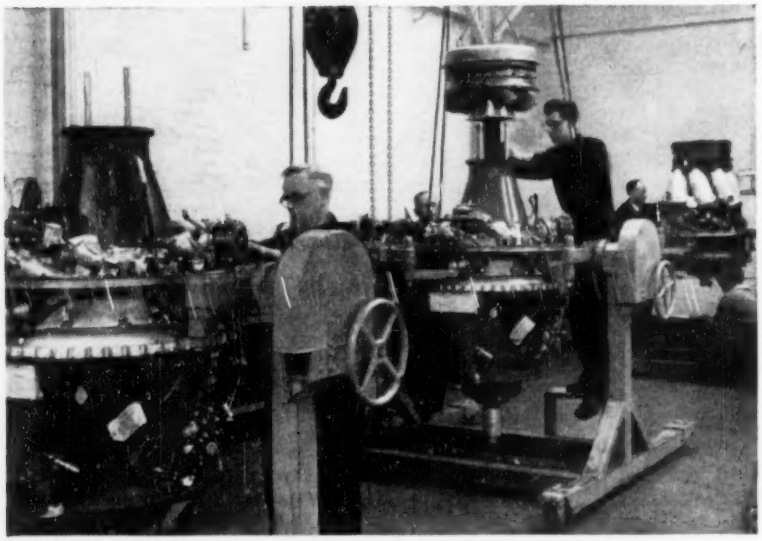
FRONT CASING is shown being fitted to first stage of two-stage centrifugal compressor on Dart engine.



DART on test stand for green run. One of 10 production Darts is torn down after test for inspection.

CONVAIR 340 AIRFRAME WITH FOUR DART TURBOPROPS (added by artist) would look something like this.

VISCOUNT 700D fitted with Dart 510s and fuel slipper tanks would look like this.



DERBY OVERHAUL SHOP reassembles Darts after service on BEA Viscounts.

Capital Airlines next March.

Further U.S. interest in the Dart comes from Convair where a four-Dart version of its Convair-Liner 240 airframe is being seriously considered to compete with the Viscount. Fairchild also is interested in U.S. manufacture of the Fokker F-27 feederliner powered by two Darts, and at least one of Lockheed's future transport proposals is being engineered around four advanced Darts. Douglas has picked the R.B.109 for a variety of its future commercial projects including the DC-7D and its twin-engine helicopter.

▶ **Westinghouse Rights**—The Aircraft Gas Turbine Division of Westinghouse Electric Corp. has U.S. sales and manufacturing rights for Rolls engines. It is likely that any sizable demand for Rolls turboprops by American airframe manufacturers would be handled by production under license at the Westinghouse Kansas City plant.

Rolls is now well into its tenth year on Dart development and is pushing its current program toward the twin goals of boosting power to 2,000 shaft horsepower and increasing service life to 1,500 hr. between overhauls. Darts now flying with the airlines are the Model 505 rated at 1,400 shaft horsepower plus 365 lb. jet thrust.

Rolls' Aero Engine Division at Derby is now in production on the Model 506 Dart, which will be delivered to all Viscount customers whose orders follow Trans-Canada Air Lines. The Model 506 is limited to the same takeoff rating as the Model 505 because it uses the same reduction gear.

▶ **Reduction Gear Unchanged**—Rolls has been using the same reduction gear developed for the original 1,000-shaft-horsepower rating of the Dart and has pushed it to the limit in absorbing the current 1,400-shp. takeoff power of the 505. Use of the increased power offered by the Model 506 is limited to cruising operations where from 4 to 7% improvement is available depending on speed and altitude. With the increased cruise power goes an average reduction of 5% in specific fuel consumption.

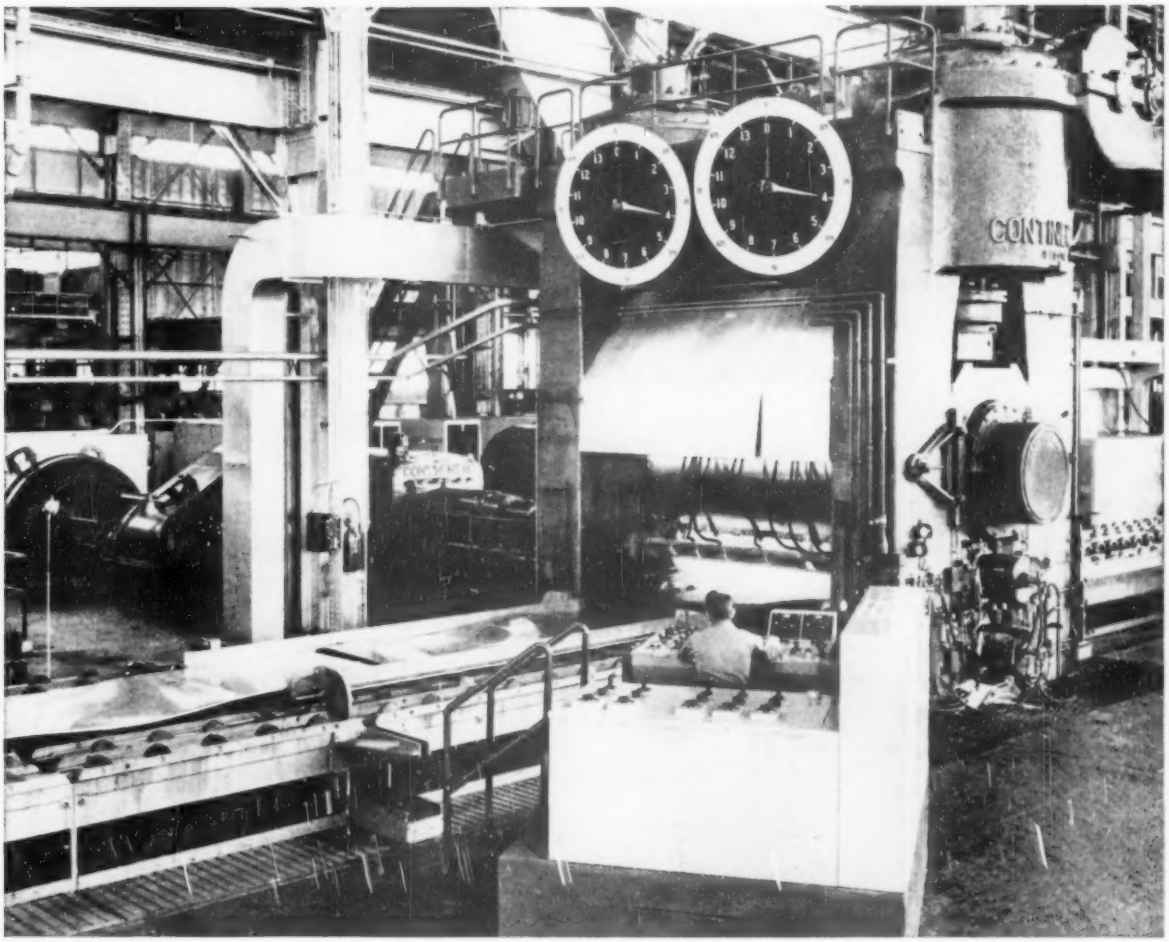
Improvements on the Model 506 engine are the result of Rolls policy of pushing component development. Rolls engineers emphasize how this pays off in the development life of an engine. The Model 505 Dart produces 4,400 shaft horsepower at its turbines. Total of 3,000 hp. is required to operate the two-stage centrifugal compressors, leaving a residue of 1,400 for takeoff.

Any improvement in component efficiency pays off directly in increased power delivered to the propeller, since the power required for the compressors remains constant.

▶ **Polished Vanes**—Thus even minor improvements made in the Model 506 components produced an additional 150 hp. These improvements include cleaning up the rotating guide vanes of the compressors by thinning the leading edges and polishing the vanes instead of leaving a shot-peen finish, and increased space/chord ratio on the nozzle guide vanes for the high-pressure turbine.

The Model 506 is regarded by Rolls as strictly an interim engine to provide

TAPERED SHEET
by ALCOA!



Putting the taper in aluminum sheet and plate is no longer the operation of skin mills alone. A powerful new production tool in the form of *the world's largest tapered sheet and plate rolling mill* has been activated by Alcoa. By using roll tapered sheet or plate, manufacturers make use of the tremendous productive capacity of this mill without the expense of installing and operating batteries of skin mills. They make full use of the protection offered by cladding—using standard properties, *the cladding on this sheet tapers with the core*—and the cladding is on both sides of roll tapered sheet!

Alcoa® Tapered Sheet and Plate is another example of the teamwork that goes into every Alcoa product. It has received team co-operation from alloy selection to final inspection. Alcoa specialists, highly skilled in their fields, have carefully guarded the working temperatures, pressures and speeds—assuring a uniform, high-quality product from the start.

Today, Alcoa Tapered Sheet and Plate sheathe America's air arm—like the Boeing B-47 and B-52 . . . and the Northrup F-89. For complete information about all our aviation facilities—especially this new rolling mill—write: ALUMINUM COMPANY OF AMERICA, 1800-M Alcoa Bldg., Pittsburgh 19, Pa.

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ALUMINUM COMPANY OF AMERICA

UNDER ONE ROOF

By James J. Haggerty, Jr.
(No. 8 in a series)

"GAP-6 workers completed 92½-ton jet bombers ahead of schedule while tooling to make 50,000 airplane parts"

Says James J. Haggerty, Jr., Aviation Staff Writer, Collier's

Here is a job well done—emphasizing the efficiency of completely-integrated aircraft production *under one roof*.

This is the story at GAP-6 (Government Aircraft Plant No. 6) in Marietta, Georgia, operated for the U.S. Air Force by Lockheed and now turning out B-47 jet bombers and big C-130A turbo-prop combat transports. Only at GAP-6 is there so much room under one roof—76 acres, combining room for four spacious assembly lines with a gigantic fabricating area where 50,000 parts are now being made with room to spare.

The size of the main building has contributed much to GAP-6's fine 3-year production record of never missing a schedule—making for fast flow of materials and communication, thus reducing man-hours. Equally important is the enthusiastic teamwork of these Georgia aircraft workers. In 3½ short years a close-knit team of 14,800 workers has been developed—with a spirit and determination to do a good job unmatched in the industry.

Already a vital part of America's defense industry, GAP-6 in Georgia can easily produce still more and still bigger aircraft.

U.S. Air Force
Govt. Aircraft Plant No. 6

Lockheed
Aircraft Corporation

Georgia
Division, Marietta

(a Lockheed advertisement)

ROLLS-ROYCE TECHNICIAN fits shrouded turbine blades on Dart turbine.

improved cruise performance for Viscount operators until the Dart Model 510 is available. The Model 510 is designed to take advantage of all the Model 506 component improvements over the full operating range of the engine plus additional turbine modifications that will offer better altitude performance.

Manufacturing is now under way on the Model 510 at Derby and the first engines are expected to be delivered next summer. Central African Airways will be the first operator to use the Dart 510 on its Viscount 700D next November. Central African will need the additional Model 510 performance for its operations from airports combining high altitudes and high temperatures.

► **Same Weight**—The Model 510 will deliver 1,550 shp. at takeoff and offer a further advantage of an average 3% improvement in cruise performance at altitude. Specific fuel consumption will be 0.77 lb. per hp. per hr. at sea level.

In addition to a new reduction gear that will stretch well beyond the Model 510 takeoff power, the new model will incorporate triple tip seals for the turbine blades. Some of capital's Viscounts will be delivered with Model 506 engines, but the bulk of the order will be equipped with Model 510s.

The Model 510 will have the same weight and dimensions as earlier Darts. Rolls estimates that conversions of all models from the 505 to the 506 and 510 configurations can be made during a major overhaul.

► **Power and Economy**—Rolls has a further development stretch of the Dart in the mill aimed at providing 1,800 to 2,000 shaft hp. for takeoff. This model, known as the RDa.7, will feature compressor improvements and addition of a third turbine. American manufac-

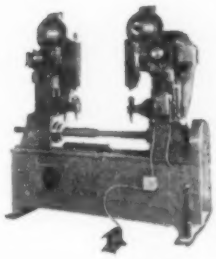
Save Labor... cut costs with

FASTER **Riveting and Clinching!**

T-J

RIVITORS

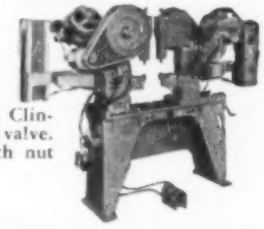
T-J RIVITOR used for automotive clutch plate assembly. Saves time and labor doing a four-fold job—assembling, setting, inspecting and ejecting.



DOUBLE RIVITOR sets two rivets at a time! Equipped with 10" hoppers, and tooled to automatically feed and set two ¼" dia. x ⅝" long wagon box head rivets at a time in elevator chain and raddle or elevator flight assemblies for farm implements. Controlled by one foot pedal.

CLINCHORS

T-J CLINCHOR . . . one of six special 8" throat Underfeed Clinchors used by a large automotive body manufacturer. Feeds and sets 11/16" square cased nuts in outside quarter panels, left and right hand.



DOUBLE CLINCHOR sets two nuts at once! Tooled to feed and set ¾" x ½" x 1/16" thick Fabri-Steel nuts at each operation. Both Clinchors tripped by same foot-operated valve. Adaptable to wide range of clinch nut setting problems.

Automatic Feeding and Setting!

T-J meets your needs for labor saving SPEED in assembly . . . with performance-proved Rivitors and Clinchors for many jobs today . . . in aircraft, automotive, farm machinery, stampings of all kinds.

T-J CLINCHORS set clinch nuts 3 to 5 times faster! Fully automatic . . . controlled by a single foot pedal! Available in Underfeed and Gravity feed models, throat depths 8" to 36".

T-J RIVITORS automatically feed and set solid rivets . . . with high production! Electrically powered Rivitor sets 1/16" to ¼" diam. solid steel rivets up to ⅞" long. Air-powered Rivitor sets aluminum alloy rivets up to ¼" diam. or steel rivets up to ⅛" diam. and up to ¾" long. Throat depths 8" to 36".

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Co., Jackson, Mich.

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Digital

Analog

Converter

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By using precision servo components, the accuracy of ADAC has been reduced to one part in 4096 (.02%), or approximately 5 minutes of transmitter rotation. It weighs only 2½ pounds and measures three inches in diameter and four inches in length. The device is hermetically sealed and is highly shock resistant. The T3100 Servo Amplifier provides the necessary excitation for the servo elements of the Converter. A direct drive ADAC providing the segmented drums and necessary gear trains, and an inverse ADAC for digital-analog conversion is available.

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turers report Rolls is offering prototype RDa.7 for delivery in about three years. Most of the advanced U.S. transport proposals incorporating the Dart are anticipating this model.

Rolls development engineers emphasize that their philosophy combines the goals of increased power with improved operational economy.

"It's simple enough to just open up the engine and move more air to get increased power at the price of less operational economy," they told AVIATION WEEK. "We are after the increased power only if we can get economy too. To do that it is necessary to increase the efficiency of engine components."

▶**Commercial Design**—The Dart is one of the few gas turbines in the world today that was designed from the start as a commercial engine. Rolls credits this initial approach with much of the success of the Dart in airline operations. Emphasis in Dart design was on the reliability required for commercial service rather than the pure power sought by the military.

When the Dart was laid down in 1945 its design was aimed at only 1,000 shp. and Rolls components that had been service-tested in other engines were used where possible. For example, the two-stage centrifugal compressor on the Dart is basically the same design as the two-stage supercharger on the Merlin piston engine that had been proved in wartime combat operations on the Spitfire and Mustang.

With the relatively lower power goals of the Dart also went relatively low turbine temperatures that are a major aid in achieving operational reliability for gas turbine powerplants.

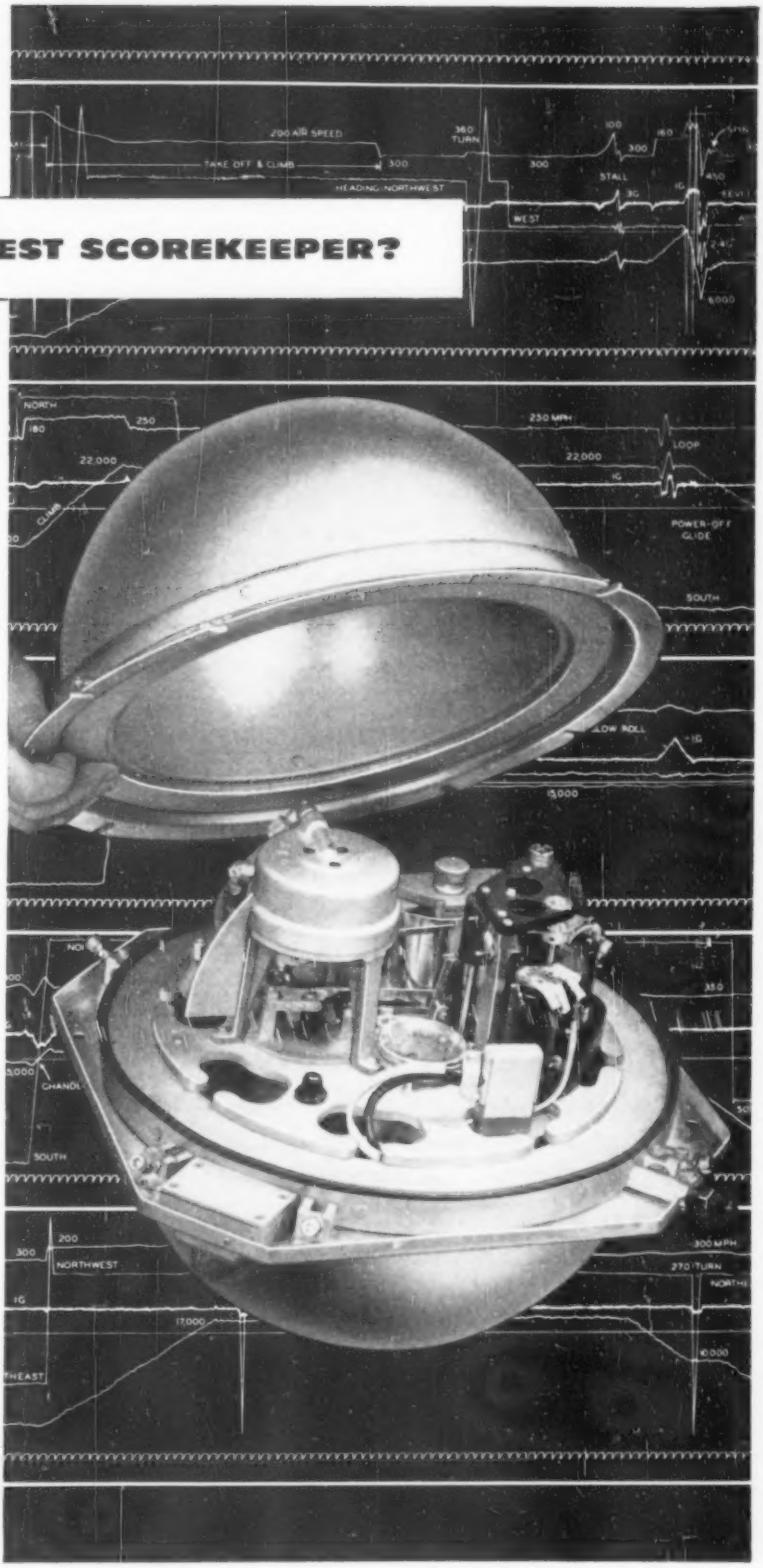
▶**Flame Tube Problem**—The Dart recently has been given technical clearance by the British Air Registration Board to go to 1,050 hr. between overhauls in airline service. Rolls' goal is now to increase this interval to 1,200 hr.

British European Airways has been operating its Darts at 750 hr. between overhaul with some of its engines now having a total service of 1,800 hr.

Flame tubes have been the most critical maintenance item on the Dart, despite relatively low operating temperatures. BEA is now changing flame tubes at 500 to 750 hr., but Rolls has developed a new flame tube that it hopes will last 1,200 hr. BEA inspected some flame tubes after 400 hr. service and found signs of deterioration. However, similar checks at 500, 600 and 750 hr. revealed little more damage than the 400-hr. check.

Rolls developed a section to replace the damaged area that can be hand-welded onto the flame tubes during overhaul. However, due to its maintenance schedules, BEA prefers to replace the flame tubes rather than re-

WORLD'S TOUGHEST SCOREKEEPER?



THE modern airplane is a hardy bird—only the roughest landings, the fiercest buffetings aloft are likely to strain its structural members. But how can you judge whether a jolt is serious enough to cause internal damage? That's where the *General Mills Flight Recorder* comes in.

This new device records the exact amount of punishment the airplane has taken; it tells maintenance men at a glance whether an expensive structural inspection is necessary. The *Flight Recorder* etches a continuous 300-hour record of heading, airspeed, vertical acceleration and altitude on aluminum foil. In event of a crash, its priceless data will survive a 2,000°F fire or shocks of 100 G's; the instrument will keep on working for a full 15 minutes after the aircraft's power fails.

Sound engineering and precision craftsmanship go into every General Mills Flight Recorder; the same high level of excellence identifies sub-contract production and contract research at the Mechanical Division of General Mills.

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THIS NEW BOOKLET tells the whole interesting story of the Mechanical Division. A copy will be gladly sent in response to your request on your company letterhead. Address Dept. A-3, Mechanical Division of General Mills, 1620 Central Ave., Minneapolis 13, Minn.

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MECHANICAL DIVISION OF General Mills, Inc.

place the worn areas by hand-welding on the new section.

Failure of small spacing gears in the torquemeter was a persistent service problem that required a change in gear design.

▶ **Service Organization**—Turbine blade failures were also encountered during ground operations below 10,000 rpm. These failures were traced to a slight dimension reduction authorized to ease machining operations during production. While the original dimensions were being restored to production blades, the BEA engines were restricted from operating at the rpms. where resonance occurred. This had no effect on flight operations and simply meant that the Viscounts had to taxi at either faster or slower engine rpms. than normally.

Rolls learned during its initial venture into the airline market with the Merlin in the Canadair DC-4M airframe that a strong service organization is necessary to stay in commercial competition. Its service department is now organized into two divisions and is being expanded to handle the growing load of Viscount operations.

The Field Service Department maintains liaison with Dart operators, closely monitoring engine operations and maintenance, providing operators with manuals and arranging training for airline personnel in the Rolls service school at Derby. First batch of Capital Airlines' technicians are now studying the Dart in the Rolls service school. Field service now maintains from three to seven men permanently with BEA at its London Airport maintenance headquarters.

▶ **Expanding Facilities**—The Technical Service Division is responsible for designing modifications for the engines to meet service requirements and eliminating persistent problems such as the flame tubes, torquemeter gears and turbine blade failures. It also operates an overhaul shop for Darts at Derby that now handles from about seven Darts weekly and is expanding its capacity to 45 Darts monthly.

Rolls now does all major overhaul for airline Darts at Derby. Its main overhaul shops are at Glasgow but all new engines going into service are handled first at Derby where there is close liaison with Engineering.

▶ **Local Tools**—Rolls policy is to encourage local purchase of tools for foreign overhaul depots and the Technical Service Department recently completed a study for Capital on the use of American-manufactured tools for its overhaul depot to be established in Virginia.

One of the main problems in cranking in service-dictated modification for the Dart is the relatively slow buildup of service experience by three European Viscount operators. European airline schedules are such that the average daily utilization on the Viscounts is only five hours a day and the BEA Darts come through the Derby overhaul shop only twice a year.

Production of the Dart at Derby has kept well ahead of Vickers Viscount demand to date. However the rising Vickers backlog on the Viscount has dictated an expansion of Dart production facilities at Derby that will be made possible by shifting the remaining production of the Griffon piston engine to Glasgow.

▶ **Started in 1943**—Rolls now has more experience in the design, testing and production of turboprops than any other engine firm in the world.

It began its turboprop work in 1943 with a propeller attached to the Derwent centrifugal-flow turbojet and, in addition to the Dart, the 3,000-shp. Clyde turboprop was designed, built and developed through 3,000 hr. of test running.

With the prototype split-compressor R.B.109 being readied for initial test running in the spring and more advanced turboprop developments looming for the future, Rolls is bent on turning its 11 years of turboprop experience into a strong bid to capture the rapidly growing airline market.

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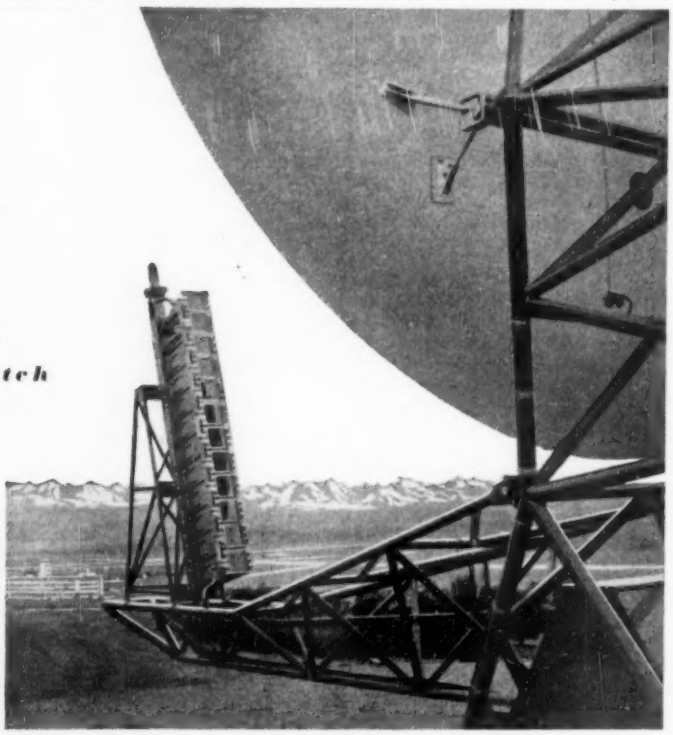

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Capital Spending Plans for 1955 . . .

Here is Good News About Business Prospects

In 1955, American industry is now planning to spend within 5 per cent of the amount it is spending this year on new plant and equipment. This is the tensely awaited result of a check-up just completed by the McGraw-Hill Department of Economics.

Hundreds of companies, by far the largest number in the eight-year history of these McGraw-Hill surveys, cooperated in the check-up. Combined, they represent 29 per cent of all industrial employment and over 60 per cent of employment in the industries where capital investment is highest. Such a broad cross section constitutes a reliable gauge of the plans of industry as a whole.

PLANS FOR CAPITAL INVESTMENT

	MILLIONS OF DOLLARS			Percent Change 1954-1955
	1953 ACTUAL*	1954 ESTIMATED*	1955 PLANNED	
All Manufacturing	$10,026	$ 9,249	$ 8,598	—7%
Petroleum Industry†	4,600	4,875	4,920	+1
Mining	506	380	311	—18
Railroads	1,312	851	769	—10
Other Transportation and Communications	2,954	2,922	2,640	—10
Electric and Gas Utilities	4,548	4,274	4,206	—2
ALL INDUSTRY	23,271	21,784	20,727	—5

*United States Department of Commerce; Chase National Bank; McGraw-Hill Department of Economics

†Petroleum refining, included under both "All Manufacturing" and "Petroleum Industry," is included only once in the total

What is the meaning of these plans, detailed by the table below, for capital investment next year? Is it good or bad news, so far as it concerns the prospect of continuing prosperity? It is to this crucial question that this editorial is addressed.

Key to Prosperity

It is not only good but very important business news that American industry plans to spend in 1955 almost as much for new plant and equipment as it is spending this year. The reason it is important is that a high level of activity in the capital goods industries is universally recognized as a particularly potent ingredient of prosperity for the nation as a whole. A dollar spent for capital goods is spent again and again for wages and materials. Its stimulating effects, called by economists multiplying effects, move through the economy in much the same way that a pebble tossed into a pond creates a widening circle of ripples. This is one reason why there is such intense business interest in the surveys of plans for capital investment.

Here are the principal reasons why the results of the McGraw-Hill survey are a good omen for continuing prosperity:

1. American industry is demonstrating that it does not need the stimulus of war-created shortages, or a rearmament boom, in order to maintain a very high level of capital investment.

The slight decrease now planned for 1955 will still maintain a level only about 11 percent below the all-time peak attained in 1953 under the stimulus of a defense expansion boom.

2. Capital investment promises not merely to stabilize at a high level, but actually to increase as 1955 goes on and thus give renewed stimulus to business.

The level of investment now planned for 1955 by *industry* — manufacturing, petroleum, mining, transportation, communications and utilities — is within 5 per cent of 1954. Contract awards for *commercial* construction — stores, office buildings, warehouses and other service establishments — as compiled by the McGraw-Hill publication ENGINEERING NEWS-RECORD, indicate a substantial increase in 1955. Thus total capital expenditures by *all business* may be very close to this year's total.

Actually, in the fourth quarter of 1954, business capital expenditures, as reported to the U. S. Department of Commerce, are down about 2.5 per cent from the average for the year as a whole. So there is a good chance that during 1955 the annual rate of capital investment will rise above this present level.

Effect of Tax Changes

The plans reported by the McGraw-Hill survey are preliminary plans, reported at the beginning of the period of business budgeting for 1955. As budgets are completed, new projects may bring the total expenditure that is planned even closer to this year's figure and thus make an even greater contribution to continuing prosperity.

But it also cannot be too strongly emphasized that these are plans; they are not accomplished investments. As such they have the vulnerability to changed conditions that characterize any plans.

There is some indication in the results of the McGraw-Hill check-up that one change in conditions recently made by the United States government has had an important stimulating effect on plans for business investment next year. It is a liberalization of the allowances for depreciation. Apparently encouraged by this provision, most of the smaller companies are planning to maintain or increase their purchases of new equipment next year, whereas during the past three years their expenditures have been declining. This is obviously a development that strengthens our economy.

A government insensitive to the key importance of capital investment by business, both in providing prosperity and in raising our standard of living, might easily destroy the present plans. One of the easiest and surest means to do this is excessive taxation of business profits which are the key ingredient of business investment. Whether the extraordinarily constructive program recently enacted by the federal government in the field of business taxation can be sustained remains to be seen. **If it can be sustained, the remarkably cheering plans of business for capital investment in 1955 can readily become firm foundations for a continuing prosperity.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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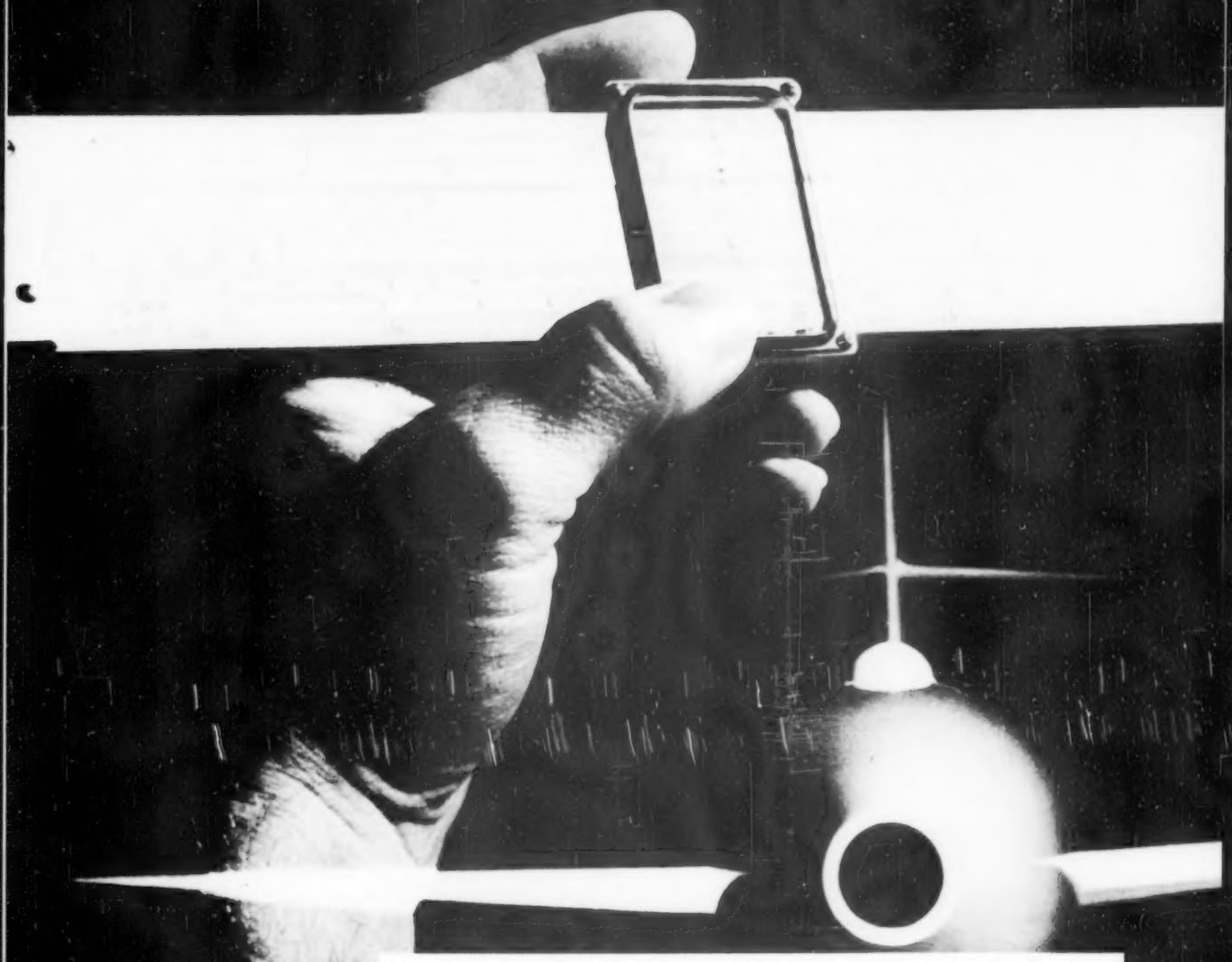
TOMORROW'S AIRCRAFT: *One step closer*



Prototype to production . . . in shorter time and at less cost

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NOW . . . find out more about this unique source and the four big ways Westinghouse can help you . . .

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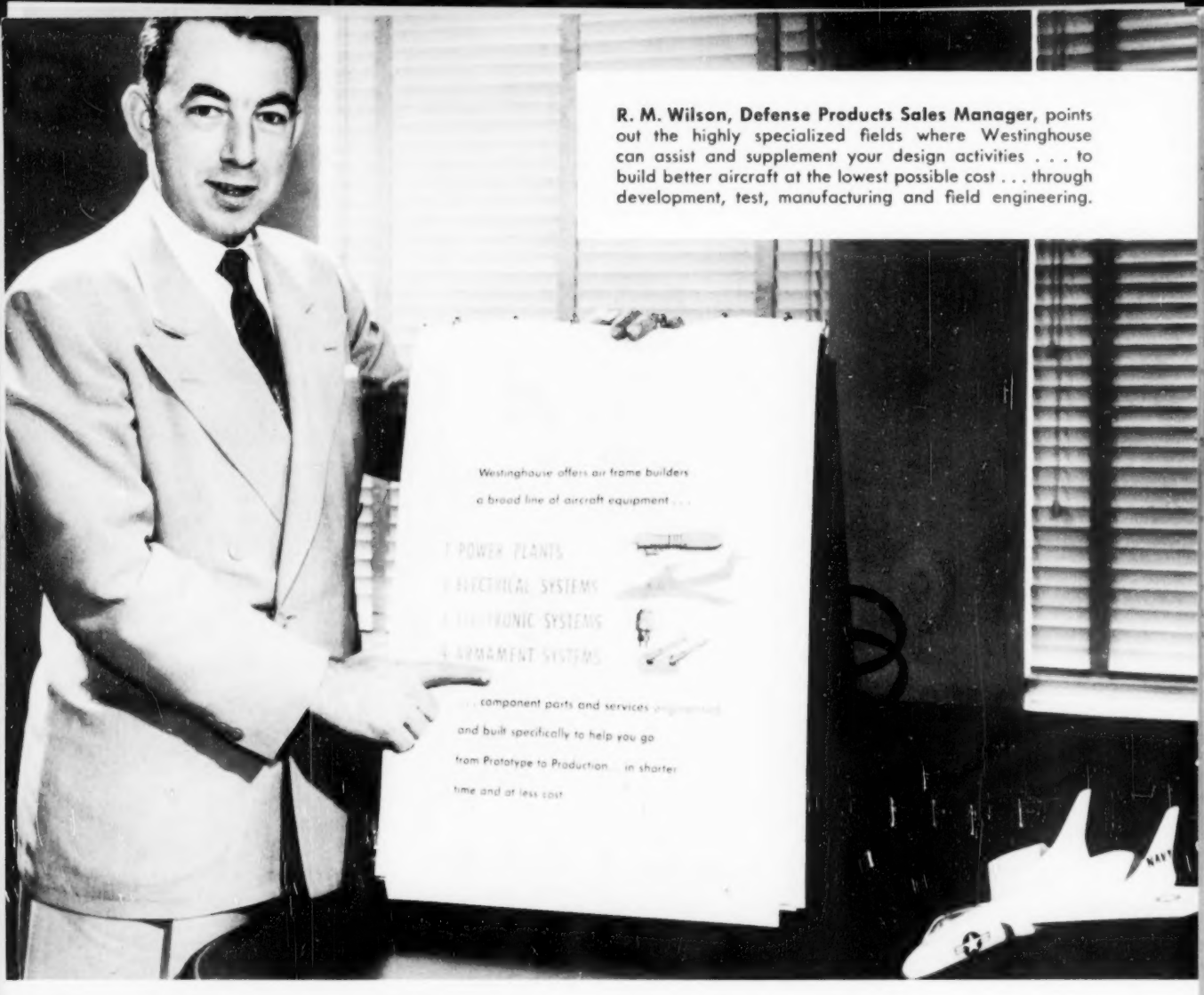
R. M. Wilson, Defense Products Sales Manager, points out the highly specialized fields where Westinghouse can assist and supplement your design activities . . . to build better aircraft at the lowest possible cost . . . through development, test, manufacturing and field engineering.


Westinghouse offers air frame builders
a broad line of aircraft equipment . . .
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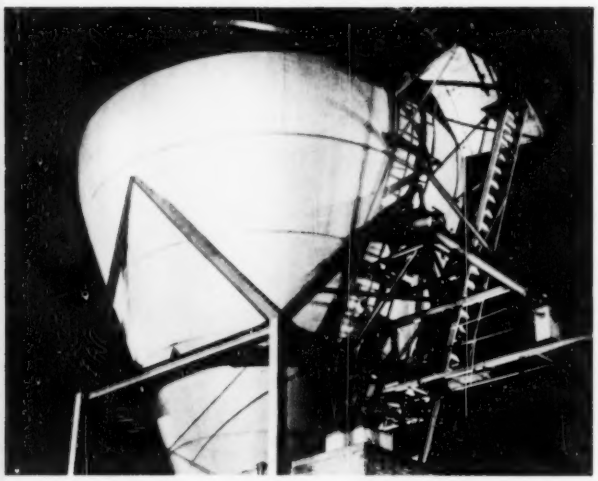
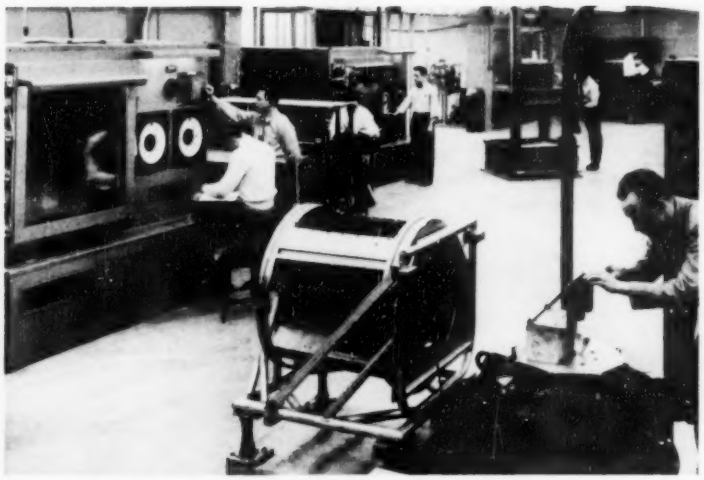


The Van de Graaff generator of the Westinghouse Research Laboratory has long been recognized as the symbol of scientific pioneering undertaken by the Corporation. Efforts spread over the whole realm in search of new knowledge . . . much of which has contributed to the advancement of aviation.



At Air Arm Division, environmental type-test laboratories have every possible facility to test components and complete systems to the most rigorous specifications. This includes impact, vibration, sand and dust, salt spray and acceleration—with tests and evaluations being made throughout development and production.

Development labs constantly advance state of the art . . . are prime source of better systems concepts

Westinghouse has a basic credo: To develop the type of equipment and complete systems which will help airframe and equipment builders meet military and commercial specifications. Emphasis is on sound progress with the highest possible degree of dependability. To implement this, Westinghouse has over twenty-three laboratories working in every area where aviation may possibly be advanced, and these labs are staffed and equipped with attention to every skill and necessary device. The result: History has shown that Westinghouse research and development contribute continually to aviation progress—is a prime originator of new ideas and concepts. Here, then, is a potent source for better equipment and improved aircraft performance, from an experienced supplier capable of giving you the most for your aircraft dollar.

But what about test and evaluation? . . .

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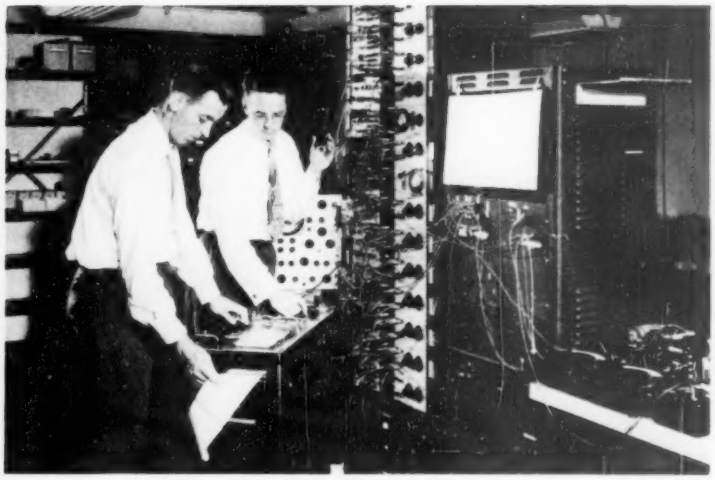


Westinghouse experience and facilities are invaluable when new concepts need a head start. Here, engineers skilled in the particular problems of aircraft electrical systems analyze a new project in the research room—with an analogue computer for running the gamut of every possible parameter—the first step toward design qualification.

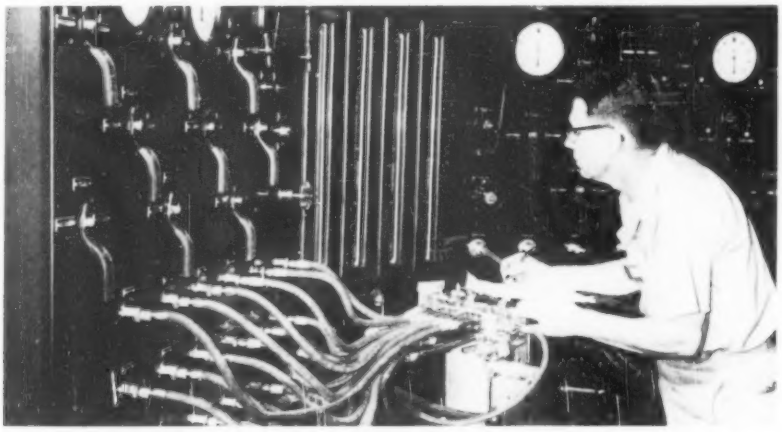
The Aviation Gas Turbine Headquarters has one of the country's largest and most complete model shop facilities. A complete factory in itself, it is the center of continuing development and product improvement. New ideas are taken from design layout to prototype stage, then evaluated by actual performance testing.

Every known test used to prove components, qualify products . . . from concept to actual service

Westinghouse believes there is no substitute for real, in-flight shakedown. At Air Arm, all equipment is given this final evaluation. Complete facilities are available to operate flying test beds and at present there are eight types of aircraft being used on various projects. The 25,000-square-foot hangar connects directly to the new Friendship International Airport. By going to such extensive facilities, Westinghouse proves out its own equipment designs and reduces the burden of "de-bugging".

From long experience, Westinghouse knows the best plan is side-by-side development, test and evaluation—for no product or system is better than its ability to perform to specifications. Each Westinghouse Division has complete facilities—many of them Westinghouse-developed—for all required mechanical and environmental tests, simulating every possible airborne situation. Reliance is always placed on proved components and qualified products as the soundest answer to advancement. This Westinghouse test and evaluation concept is applied to products and systems at every stage of development and on through manufacture to actual service. It is one of your best guarantees that this source of ideas and products offers unusual "extras" in reliability, can give you extensive help in meeting the rugged test of specifications—all the way.

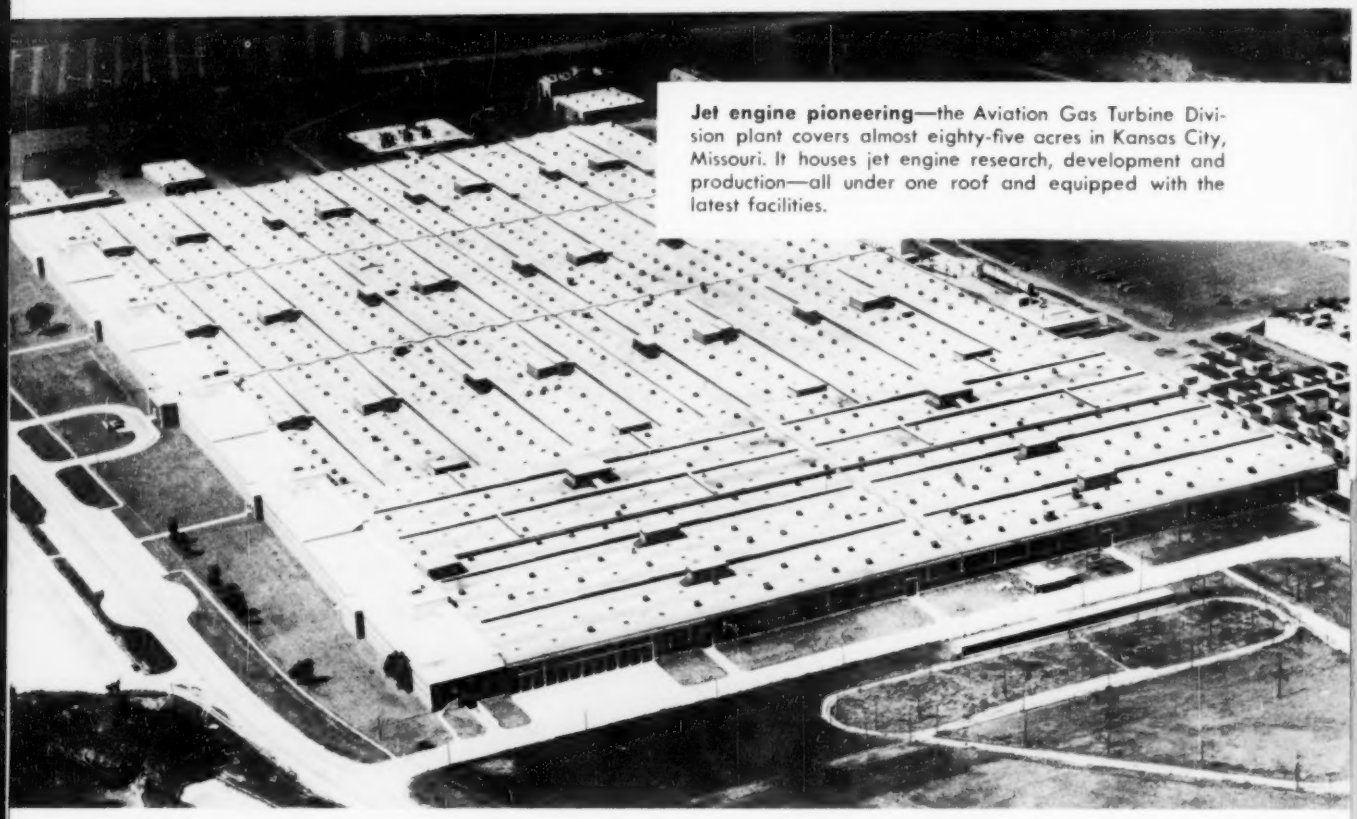
YOU CAN BE SURE...IF IT'S Westinghouse



The Aviation Gas Turbine Division—like all Westinghouse Divisions—places great stress on test, evaluation and qualification of all components and products. Here, a jet engine accessory is being given a complete operational check prior to release for installation. This same attention to performance follows every engine from development through production, where completed engines are given two complete test cell runs to prove that they meet specifications.

Life testing of all electrical apparatus plays a vital part in the Aircraft Department of the Small Motor Division. Highly specialized facilities—similar to the one shown above—test generators and motors under full load to determine brush life and stamina. The results are then cross-checked with other evaluations, such as high altitude chamber tests. Complete systems and their components can be tried and proved for performance under any climatic or mechanical environment.

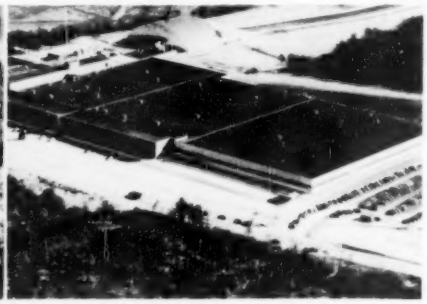
Now, the end result of all this . . .



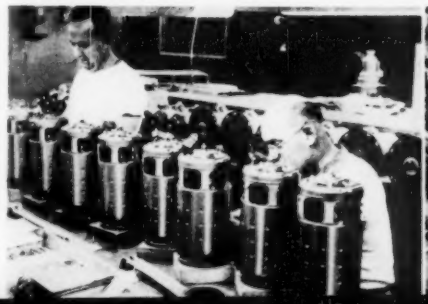
Jet engine pioneering—the Aviation Gas Turbine Division plant covers almost eighty-five acres in Kansas City, Missouri. It houses jet engine research, development and production—all under one roof and equipped with the latest facilities.

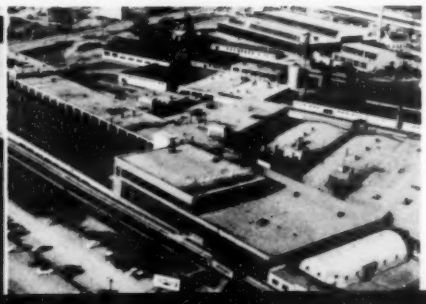
Specialized plants and corporate facilities give capacity, flexibility . . . produce to specifications

Westinghouse in aviation also means the best and most complete plants and production facilities capable of building precision and ruggedness into every product. The Westinghouse aviation family offers three-way flexibility to assure both quality and quantity: Twenty-three divisions specialize in their product lines; strategic locations and special headquarters facilities put product "families" close together, make it possible to utilize skills and capacity of other plants whenever necessary; modern production equipment takes full advantage of new techniques, constantly produces to close specifications. These are all big reasons why Westinghouse can offer such extensive help in backing up your design efforts on new aircraft.



The Air Arm Plant in Baltimore integrates all airborne electronics activities under a single, Westinghouse-owned roof. Complete development, test and manufacturing facilities are available to you, the finest anywhere in the industry.





The Small Motor Division at Lima, Ohio, combines experienced technology, modern equipment and extensive "mock-up" facilities to design and build highly advanced aircraft electrical systems, drives, motors and controls.

Engineering follow-thru insures performance, gives user full value of equipment and systems

From prototype on, Westinghouse field engineering is of vital assistance in helping you qualify the aircraft for operational service. Engineers are highly skilled in their product lines, ready to provide all necessary assistance for successful use of products and systems. This also is a Westinghouse credo: To assure product performance, to give the user benefits of continuing technical advances in design and application, and to assist in training of operational and maintenance personnel. By providing this full measure of service, Westinghouse can intelligently and sincerely offer airframe and equipment manufacturers a complete partnership, directed toward selection and application of the best possible equipment and systems for the job.

Now . . . see how to put Westinghouse on your team . . .

YOU CAN BE SURE...IF IT'S Westinghouse

Look to Westinghouse—get newer concepts, better systems for greater margins of technical superiority . . . prototype to production

By now we're sure you realize . . . aviation is very much our business. These Westinghouse facilities—barely covered here—offer you a real, hard-working source for solving aviation problems. Advancement comes both from individual product developments and from basic areas like metallurgy, fuels, combustion and nuclear energy. Much of it, of course, is classified, but readily available for use by qualified recipients.

The real story here is how we can help you. Whatever your problem, at any stage of design or modification—whether in airframe work or equipment manufacture . . . it's a good bet that Westinghouse can give you valuable assistance. But most important, Westinghouse has the unique capability to help you all the way—all the way from prototype to production, and help you do it in shorter time and less cost.

Here is the Westinghouse Aviation Family, covering every phase of aircraft operation:

Basic aircraft systems

Turbojet Engines • Fire Control • Radar • Autopilots • Communication Equipment • Electrical Systems • Defensive Systems and Guided Missile Components.

Airborne system components

Transformers • Rectifiers • Instruments • Gyro-motors • Temperature Control Panels • Generating Equipment and System Control • Circuit Breakers • Contactors • Motors • Actuators and Hoists • Electronic Tubes • Magamps • Micarta®.

Ground equipment

Wind Tunnels • Airport Lighting • Industrial Plant Apparatus.

TO GET INFORMATION OR ACTION

Call our local Representative or write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

For general information and technical literature, just check and send the coupon below. . .

AP-4001

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Gentlemen:

I am interested in getting literature and product information as follows:

- ☐ Advancing Automatic Flight **B-6372**
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- ☐ Jet Engines
- ☐ Aircraft Electrical Systems
- ☐ Aircraft Motors
- ☐ Airborne Radar
- ☐ Automatic Pilots
- ☐ Armament Systems
- ☐ Other.....

Name.....Title.....

Company.....

Street.....

City.....State.....

COMPLETE ORION SYSTEM includes remote compass transmitter, course director computer, slaving amplifier and inverter, slaved directional gyro and course and function selector.

Business-Plane Navaid Costs $775

New Orion flight director makes it easier for pilot to center on ILS localizer beam without bracketing.

A new low-cost, lightweight flight director for business aircraft which simplifies ILS approaches and omnirange flying has been announced by Orion Industries, Inc., Richmond, Va.

For aircraft equipped with the newer electrical, magnetically slaved directional gyros, the flight director adds only 2½ lb. and costs only $775. For aircraft using the older, unslaved air-driven gyro, a complete system including flight director computer, slaved DG and associated equipment, weighs 10 lb., and costs approximately $1,800. This complete package provides a heading gyro which never needs to be reset to the compass, in addition to the flight director features.

In its operational capabilities, the new Orion device more closely resembles the Bendix Omni-Mag (AVIATION WEEK Oct. 25, p. 58) and Wilcox CAT (AVIATION WEEK Apr. 20, 1953, p. 55) than the more sophisticated Sperry and Collins flight directors.

► **Crosswind Compensation**—Primary role of the Orion device is to make it easier for the pilot to get centered on the localizer beam without bracketing. Important feature of the device is that it automatically provides crosswind compensation for crab angles up to 20 degrees, without causing the plane to fly slightly off beam center, as with some flight directors. It also provides crosswind compensation when flying the VOR airways.

The complete system, for aircraft not now equipped with a slaved gyro, consists of:

• **Course director computer,** in which magnetic heading and localizer receiver signals are suitably combined. Computer also contains automatic crosswind compensation circuitry. Two vacuum tubes are employed.

• **Course and function selector,** a cockpit panel instrument by which pilot selects operating mode—ILS localizer (either front or back leg), omnirange, or magnetic heading. Selector is also used to set in magnetic heading of the ILS runway or the heading pilot wants to fly when off the airways.

• **Slaved directional gyro,** a rebuilt version of a Sperry air-driven DG, modified to provide slaving to a remote compass transmitter. Modified unit reportedly holds magnetic heading within one degree.

• **Remote compass transmitter,** which is mounted in wing, tail, or other location remote from stray magnetic fields.

• **Slaving amplifier and inverter,** a combination unit which slaves gyro to compass and provides a.c. power required for the system. Amplifier uses two tubes.

Output of the new flight director system is displayed on the vertical needle of a conventional ILS panel indicator (not furnished with the system).

The Orion director is available for either 14-v. or 28-v. d.c. operation. Company says it has used JAN-spec parts to assure good equipment reliability. Six of the new devices are now in use and an equal number are slated for installation soon, Orion reports.

Company's address is 1711 Ellen Road, Richmond, Va.

Avionics Industry Opens New Labs

Purchase of the American Gyro Corp., Santa Monica, Calif., by Daystrom, Inc., Elizabeth, N. J., is one of several recently announced corporate changes and company expansions in the avionics field.

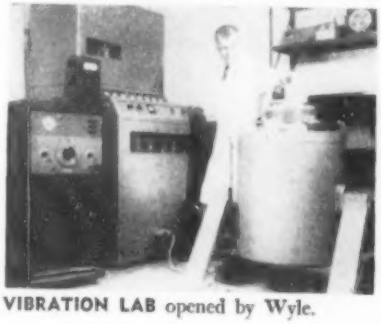
American Gyro Corp., currently producing rate and displacement gyros at rate of $2½ million annually, will continue to be operated by present management, headed by John Bamford, president. Daystrom, whose instrument and electric divisions are avionics suppliers, also owns about 50% of the stock in Weston Electrical Instrument Corp.

Other expansions and changes:

• **New interference filter labs** and production facilities are under construction by Sprague Electric Co. in the Venice section of Los Angeles. The 13,000-sq. ft. facility, which will also house sales offices, is expected to be completed next spring.

• **New snap-action switch research** and production development center is being opened in Denver by Micro Switch division of Minneapolis-Honeywell at 387 Corona St. to supplement main plant facilities at Freeport, Ill.

• **New West Coast analog computation center** has been opened by J. B. Rea Co., Santa Monica, using equipment made by Electronic Associates, Inc. Facilities include 72 operational amplifiers, six servo-multipliers and six func-



VIBRATION LAB opened by Wyle.

for outstanding performance—out front

make sure it's a SENSENICH

Everywhere you go you see personal planes sporting Sensenich propellers—an obvious fact when you realize that more light planes are equipped with Sensenich props than any other make. This universal acceptance by both the industry and the flyer is advance-proof of your complete satisfaction.

METAL... Fixed Pitch CAA approved up to 135 hp.

WOOD... Fixed Pitch CAA approved up to 225 hp.

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TEST CLUBS up to 3,000 hp.

We'll be glad to send bulletin and price list.

Dept. W, Sensenich Corporation, Lancaster, Penna.

Sensenich PROP SHOP... prompt propeller repair of all makes fixed pitch Wood. Sensenich, Hartzell, Beech Controllables, Metal or Wood; Sensenich and McCauley fixed pitch Metal Propellers. Magnaflux, etching, anodizing and plating service.

AIRCRAFT SENSENICH PROPELLERS

SOL-A-NUT

self-locking
rustless
heat resistant

Widely used on exhaust systems, pre-heaters, superchargers and similar devices, SOL-A-NUT has proven its stamina on jet engines, too. Sturdy, one-piece stainless steel construction ensures long life . . . no corrosion if nicked or scratched. Reasonable in cost, quick and easy to spot-weld, SOL-A-NUT cuts assembly time in both manufacturing and maintenance operations.

MONADNOCK MILLS San Leandro California

Subsidiary of UNITED-CARR FASTENER CORP.

tion generators. Company also has IBM computer facility.

• **William Miller Instruments, Inc.**, Pasadena, Calif., announces that its MILAC analog computer is now available on a rental basis for such problems as flutter analysis and servo system studies.

• **Vibration laboratory**, for subjecting equipment to vibrational environments specified in MIL-E-5272 and in missiles, has been opened by Wyle Research Corp., El Segundo, Calif. Facilities include a 10-kw. amplifier which can provide sine or complex wave functions over frequency range of 5 to 3,000 cps., and a driving motor which can deliver up to 3,000 lb. thrust.

• **Clarostat Mfg. Co.**, Dover, N. H., has purchased Campbell Industries, Inc., Chattanooga, Tenn., manufacturer of resistance products.

• **Technical Industries, Inc.**, maker of miniature d.c. motors, has changed its name to Airquipment Co.

• **Clary Multiplier Corp.**, San Gabriel, Calif., has changed name of its Instrument Division (maker of gyros and servo-mechanisms) to the Automatic Controls Division.

Makers Report New Small Components

A new subminiature 3-watt wirewound resistor no larger than a conventional ½-watt molded carbon resistor, is one of several recently announced components which should enable avionic designers to reduce equipment size and weight, and boost operating temperatures.

RESISTOR matches matchstick in size.

The new sub-mm resistor, measuring $\frac{3}{32}$ in. in dia. by $\frac{3}{8}$ in. long, is available with a maximum resistance of 10,000 ohms, has vitreous enamel coating. Bulletin 111-B gives application engineering data. Manufacturer is Sprague Electric Co., 327 Marshall St., North Adams, Mass.

Other new components include:

• **Miniature panel meter**, Model 150, measuring 1½ in. in dia., is watertight and meets MIL-M-3823, according to manufacturer. Unit comes in a variety of d.c. and a.c. voltmeter, microammeter, milliammeter and ammeter types. Scale length is 1.1 in.; accuracy is within 3% full-scale. Manufacturer:

VOODOO

F-101

World's Most Powerful Fighter

Designed and developed by McDonnell engineers and technicans, the F-101 Voodoo is another outstanding milestone in the history of McDonnell engineering achievements. This supersonic twin-jet fighter is a product of a progressive and daring engineering program, in which entirely new ideas in all fields of airplane, helicopter, and missile research are under constant study and development.

Engineers who find their progressive spirit and initiative stifled by routine tasks, . . . are welcome to discuss with us the challenging opportunities open at McDonnell.

Currently needed are:

Aerodynamicists	Designers	Thermodynamicists
Stress Engineers	Dynamicists	Flight Test Engineers
Industrial Illustrators and Artists		Missile Electronics Engineers

For further information, write:

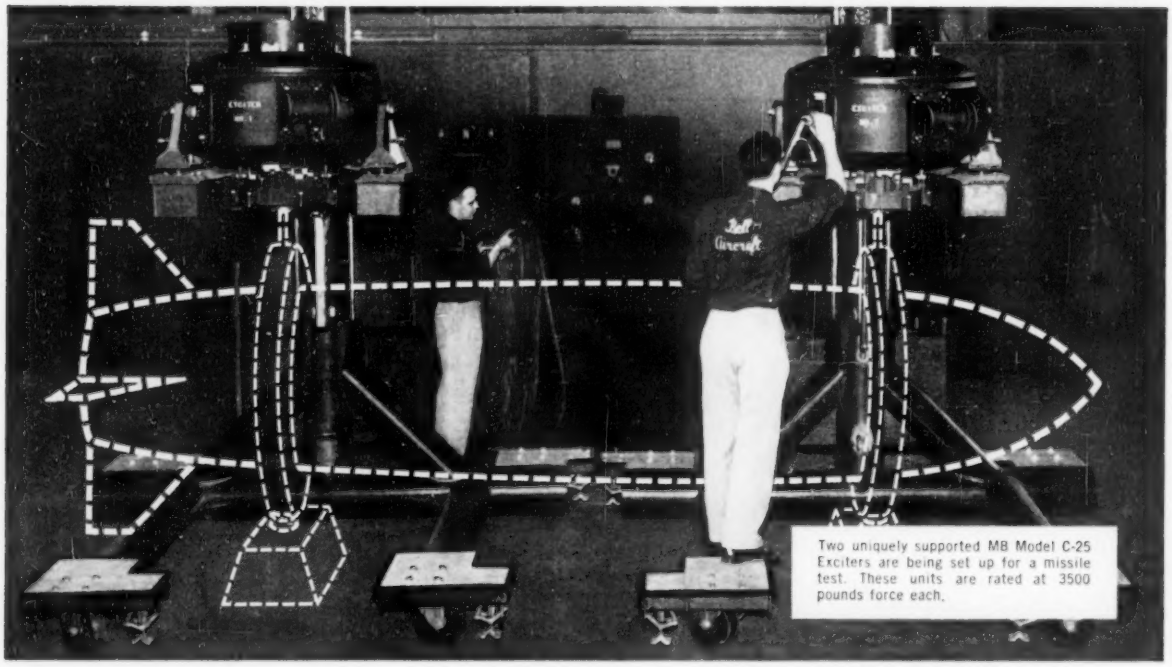
TECHNICAL PLACEMENT SUPERVISOR

P. O. Box 516, St. Louis 3, Mo.

McDONNELL *Aircraft Corporation*

Manufacturers of AIRPLANES AND HELICOPTERS • ST. LOUIS 3, MO

"Shake" tests add extra margin of reliability at BELL *Aircraft*



Two uniquely supported MB Model C-25 Exciters are being set up for a missile test. These units are rated at 3500 pounds force each.

Operation and quality quickly checked on

M B VIBRATION EXCITERS

Engineers of Bell Aircraft Corporation take advantage of the unusual help provided by shake testing – with a specially mounted setup of two MB Model C-25 Exciters for vibrating missiles.

BENEFITS OF SHAKE TESTING

Because small vibrations can be magnified in a complex missile structure, and because interactions of components are important, such testing checks vital systems. The MB shakers permit Bell engineers to produce conditions more severe than expected in service. In effect, a margin of safety can thereby be added to increase reliability of operation.

Moreover, vibration tests afford a quick, versatile means for checking quality of components. Defective and malfunctioning components are quickly detected.

To cap it all, substantial savings in manhours and fuel costs have been effected by substituting shake tests for hot firing of missiles prior to flight tests.

WHY MB VIBRATION EXCITERS?

Engineered by vibration specialists to deliver maximum performance, MB Shakers can be counted on for pure table motion and dependable operation to full rated capacity. MB's line of vibration testing "tools" is complete – from small specialized-duty shakers to the largest in existence today.

Prompt servicing provided by a special staff of MB engineers. For more information on shakers, send for Bulletin 1-VE-8.

the MB manufacturing company, inc.

1060 State Street, New Haven 11, Conn.

HEADQUARTERS FOR PRODUCTS TO *ISOLATE* VIBRATION...TO *EXCITE* IT...TO *MEASURE* IT

DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

• **Hot pot,** rated 1 watt at 200C, or 5 watts at 80C, comes in standard linearities of 0.5% or specials of 0.25%, in resistances of 1,000 to 25,000 ohms. Potentiometer measures 1 in. in dia., has rotations up to 360 degrees. Manufacturer: Waters Mfg., Inc., 4 Gordon St., Waltham 54, Mass.

• **Sub-min tube clamps,** new low-cost series 100 and 200, are made in single-piece construction of silver alloy for maximum heat transfer or in silver-plated beryllium copper. For application data, write to International Electronic Research Corp., 177 West Magnolia Blvd., Burbank, Calif.

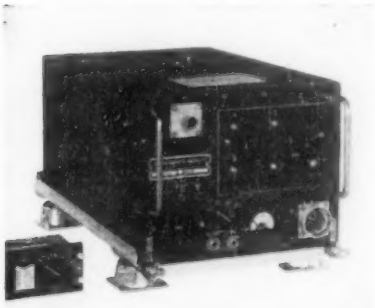
• **Cam-type rotary relay,** Series OCS, can replace whole banks of relays or combinations of relays and stepping switches, according to manufacturer. Unit weighs 14 to 20 oz., depending upon design, and measures 3¼ x 2½ x 1¾ in. For more information, write to Automatic Electric Sales Corp., 1033 W. Van Buren St., Chicago 7, Ill.

New Communications Equipments Developed

A new lightweight airborne HF transmitter-receiver, a VHF communications set for use at small airports, and a tester for checking HF and VHF transmitters, are recent additions to the field of aviation communications.

The new equipments include:

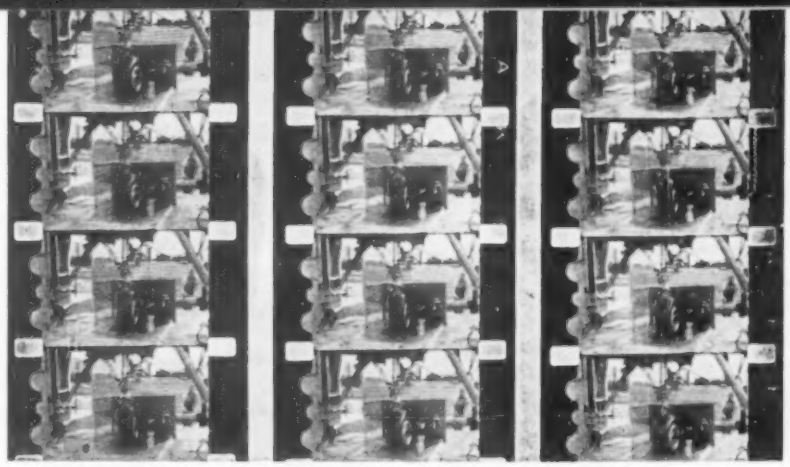
• **HF transmitter-receiver,** weighing 35 lb., provides five preset crystal-controlled channels in the 2-20 mc. band, any one of which can be remote selected. The new HTR-5, rated 20 watts minimum



LIGHTPLANE transmitter-receiver weighs 35 lb., provides five pre-set channels.

output, was originally designed to withstand rigors of helicopter use. Housed in a JAN-C-172A type BI-DI case, the unit can transmit and receive on same frequency. Manufacturer is Hamlyn Electronics Corp., Hicksville, N. Y.

• **VHF ground station,** for aircraft-to-ground communication, is crystal-controlled, rated 7½ watts output. New model VGTR-2 comes with 122.8-mc. Unicom crystal, but can be provided



Experimental nose gear is tested on Shimmy Tower. The tower has drum speeds equivalent to 150 mph, frequencies up to 25 cycles per second, shimmy amplitudes up to 10 degrees and handles loads up to 60,000 lbs.

Shimmy Tower speeds Lockheed structures development

Structures Engineers at Lockheed solve shimmy and brake chatter problems in pre-flight testing stages on their unique shimmy tower. The only one of its kind in private industry, the shimmy tower was designed to meet a constantly increasing volume of structures research and development at Lockheed.

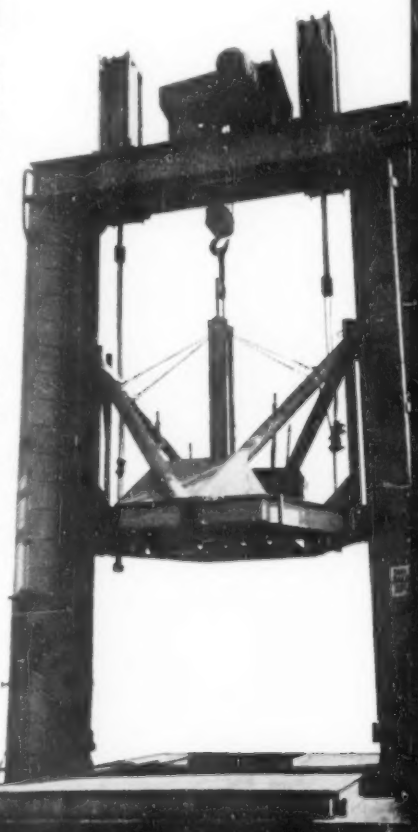
Along with Lockheed's 500,000 lb. force fatigue machine, drop test tower and other static and dynamic test machines, it provides Structures Department Engineers with unmatched research and testing facilities.

Career Openings at Lockheed

Lockheed's diversified development program in nuclear energy, turbo-prop and jet transports, radar search planes, supersonic aircraft and other classified projects has created a number of opportunities for Structures Engineers and Stress Engineers to perform important work in: 1) high temperature and its effect on structures; 2) optimization of thin wing designs and other aeroelastic problems; 3) the application of new materials such as ultra-high heat treat steel as a means of increasing strength while decreasing weight; 4) panel instability at supersonic speeds.

Lockheed offers you increased salary rates now in effect; generous travel and moving allowances; an opportunity to enjoy Southern California life; and an extremely wide range of employee benefits which add approximately 14% to each engineer's salary in the form of insurance, retirement pension, sick leave with pay, etc.

Those interested are invited to write E. W. Des Lauriers for a brochure describing life and work at Lockheed and an application form.



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75%

of all the helicopters flying today have

Franklin POWER

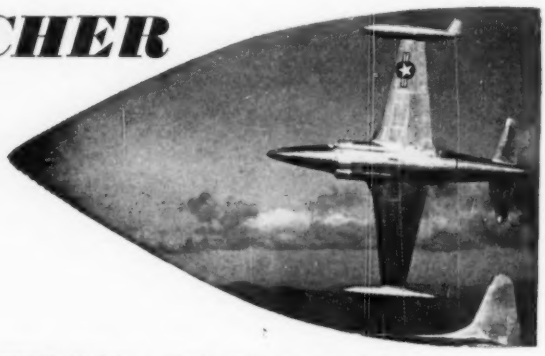
Franklin engines are used exclusively in 4 out of the 5 CAA-certificated helicopters under 400 h.p. – Bell, Hiller, Sikorsky and McCulloch. The production of these four manufacturers in the under-400 h.p. category has accounted for 75% or more of all the helicopters built so far.

Franklin's unmatched experience in helicopter power is at your disposal – as are our excellent facilities for subcontracting precision machining and sub-assemblies of highest quality.

AIRCOOLED MOTORS, INC. SYRACUSE, N. Y.

FLETCHER

builds tanks of superior quality



FLETCHER AVIATION CORP. • ROSEMEAD, CALIFORNIA • DAYTON, OHIO • WASHINGTON, D. C.

with crystals for other frequencies, or with more than one channel if desired. Equipment operates from 115 v. a.c. Manufacturer is Narco, Ambler, Pa.

• **Transmitter tester** measures output power and field strength of transmitters rated up to 20 watts, at any frequency between 2 and 150 mc. Model 2242 tester can also be used to check percentage modulation and audio quality. Manufacturer: LearCal Div., Lear, Inc., 3171 So. Bundy Dr., Santa Monica, Calif.

New Avionic Bulletins

New technical bulletins and brochures describing devices and techniques of interest to persons in the avionics field include:

• **Magnetic amplifier systems**, Form F-642, for servomechanisms, photoelectric, and regulating applications (4 pp.). Federal Telephone & Radio Co., 100 Kingsland Rd., Clifton, N. J.

• **"Kool Klamps"** for securing sub-min tubes are designed to reduce tube temperature. Catalog lists specs and mounting dimensions (12 pp.). Birtcher Corp., 4371 Valley Blvd., Los Angeles 32, Calif.

• **Electric disconnect panels**, in 18 different "Panelok" types, designed to accommodate wire sizes from 2/0 to No. 22, in four overlapping ranges. Bulletin YHS54 gives engineering data (20 pp.). Burndy Engineering Co., Inc., Norwalk, Conn.

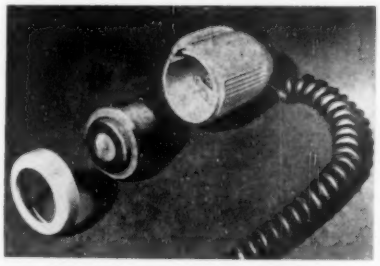
• **Recording oscillograph**, Type 5-116, providing nine or 14 active data channels, with 0.1 and 0.01 sec. timing traces (12 pp.). Consolidated Engineering Corp., 300 No. Sierra Madre Villa, Pasadena 15, Calif.

• **Min and sub-min wire and cable**, with Teflon insulation, for high-temperature use. Catalog lists variety of types. Tensolite Insulated Wire Co., Inc., Tarrytown, N. Y.

• **Relay amplifier**, magnetic, for raising low-level input sufficiently to operate heavy-duty relays. Specifications and typical circuits are shown (8 pp.). Goldak Co., 1544 West Glenoaks Blvd., Glendale 1, Calif.

• **Data processing instruments**, including transducers, oscillographs, and analog-to-digital converters, 12 pp. Consolidated Engineering Corp., 300 No. Sierra Madre Villa, Pasadena 8, Calif.

• **Selenium rectifiers and diodes**, application engineering data and specs. Bulletin SR-1A, 8 pp. International Resistance Co., 401 No. Broad St., Philadelphia 8, Pa.



Unbreakable Mike

"Practically unbreakable" transistorized microphone now comes in new molded nylon case with built-in snap-action switch. The new Model A-258 transluctance mike uses a two-stage built-in transistor preamplifier to improve speech fidelity and reduce noise (Aviation Week, Jan. 25, p. 65). Unit can be substituted directly for carbon mikes. Manufacturer: Remler Co., 2101 Bryant St., San Francisco, Calif.

Here is a steel with 90,000 psi. yield strength that you can weld or flame-cut easily

USS Carilloy T-1 Steel

gives you 100% joint efficiency without pre- or post-heating... provides amazing sub-zero toughness as well as high temperature strength

NOW, with USS Carilloy T-1 Steel, you can flame-cut or weld very high strength parts either in the shop or the field *without* the need for heat treating equipment. In addition to its great strength, this new quenched and tempered alloy steel has unusual resistance to impact abrasion.

The secret to the excellent weldability of T-1 Steel—and its durability under high impact stresses—is its amazing toughness even at temperatures far below zero. In field tests of non-stress relieved, *welded* pressure vessels, T-1 Plate Steel withstood impact wallops of 2,000,000 ft. lbs. at temperatures as low as 38° F. below zero. Steels customarily used for pressure vessels—even if stress relieved—could not take that kind of punishment. But the T-1 Steel and every weld in the vessels remained sound. The welds, made by manual arc welding with E 12015 low hydrogen coated electrodes, developed the full strength of the parent metal. No special techniques were used.

How this new steel cuts fabricating costs

T-1 Steel cuts costs in several ways. You can reduce the thickness and weight of heavily stressed parts by taking advantage in design of its very high yield strength of 90,000 psi. Thinner sections mean less welding time, less welding rod required.

You can make these welds without the lost time and extra expense of pre- or post-heating. And with no need for heat treating equipment you can fabricate or make repairs either in the shop or the field—wherever it is more convenient and less costly.

You can often take advantage of T-1's high strength to build larger size pressure vessels and storage tanks. As a result, you can build *one* vessel big enough to replace *several* of present design. Or you can build the *same* storage capacity with less steel, less welding, less cost.

Where to use T-1

Carilloy T-1 Steel is now being used to cut costs, increase service life, reduce size and weight of pressure vessels, power shovels, mining cars, and rotating machines. It is being considered seriously for use in high pressure pipe, bridges, and penstocks. It is applicable to a wide range of tough jobs where the stress is primarily tensile, where great toughness or high temperature strength is needed—in fact, everywhere that you want a very strong steel that can be welded easily.

Write for complete information. United States Steel, Room 4586, 525 William Penn Place, Pittsburgh 30, Pa.

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ELECTRIC FURNACE OR OPEN HEARTH

COMPLETE PRODUCTION FACILITIES IN CHICAGO OR PITTSBURGH

UNITED STATES STEEL

Utmost Strength in an Emergency

The New Pacific HARNESS REEL

Conforming with Type MA-2 of MIL-R-8236 (USAF)

The new Pacific Harness Reel incorporates an entirely new principle of operation as well as being designed to meet the strength requirements shown necessary by high speed jet aircraft and aero-medical analysis of crashes.

The reel easily withstands an ultimate load of 4,000 pounds and at the same time is lighter, smaller, and much more versatile in installation. Pilot is protected against being thrown in any direction and the reel instantly locks upon uncontrolled acceleration of the pilot, yet the reel permits comfortable movement in performing regular duties.

Write for New Bulletin

Pacific SCIENTIFIC CO.

1430 Grande Vista Ave., Los Angeles 23, Calif.
25 Stillman Street, San Francisco 7, California
1915 1st Avenue South, Seattle 4, Washington
111 B East Main Street, Arlington, Texas
Eastern Representative: Aero Engineering Inc.
Mineola, L.I., N.Y. • Indianapolis • Baltimore • Ottawa

LETTERS

Comet Investigation

AVIATION WEEK is to be congratulated for the most complete coverage which has been afforded its readers reporting the de Havilland Comet crashes and the resulting series of investigations, recovery of parts, full scale tests, analysis of test results, etc.

No less to be commended is the de Havilland Aircraft Co. and the British Air Ministry for the forthright release of all such information. Certainly it represents a most realistic recognition by the aircraft industry of the best interests of the air traveling public if not to the technical and management phase of aviation as well.

In past years, many of our company's personnel have, on occasion, been privileged to associate with de Havilland engineers and management, and the handling of the Comet situation as reported in AVIATION WEEK merely confirms the high regard in which we hold these people.

J. M. ANDERSON
Assistant to General Manager
Terre Haute Works
Allis-Chalmers Mfg. Co.
Box 512
Milwaukee 1, Wis.

'Lifting Fuselage'

The article on page 49 in the Nov. 22nd issue of AVIATION WEEK entitled "NACA Shows Lift-Fuselage Model" was particularly "eye catching" to us here at Central Aircraft Corp.

We sincerely hope that NACA's interest in the Lifting Fuselage will instigate broad recognition of the many inherent advantages offered by this design. Our president, Vincent J. Burnelli, designed and constructed the first Lifitng Fuselage in 1919 and further developed the Lifting Fuselage principle by building eight different models during the last 33 years.

We sincerely hope that Vince Burnelli will be given the recognition he so richly deserves for his perseverance and vision.

CHALMERS (SLICK) GOODLIN
Central Aircraft Corp.
501 Fifth Ave.
New York 17, N. Y.

LAA's Progress

Your story by Bill Coughlin about our helicopter passenger service program deserves praise. You have portrayed the facts accurately, and in a fashion so interesting that it is bound to evoke a lot of favorable comment and, I am sure, clarify what we believe to be the proper position and responsibility of our company to the public, the industry, and the government.

C. M. BELINN, President
Los Angeles Airways, Inc.
P. O. Box 10155
Airport Station
Los Angeles 45, Calif.

MOLY SPRAY KOTE® lubricant

it's NEW

in handy sprayer

a dispersion of micro-fine solid lubricants, principally molybdenum-disulfide, in "Fluron".

Deposits a uniform, dry lubricating film on metal surfaces . . . outstanding for its chemical and thermal stability and its low coefficient of friction at extreme bearing pressure.

PREVENTS GALLING & SEIZING.

Send today for details.

THE ALPHA CORPORATION
179 Hamilton Ave. • Greenwich, Conn.

Back Issues Needed

We have established a ready reference library of major aviation magazines in the National Air Museum for use by the staff and the aviation fraternity at large. This library is by no means complete. We find that the missing issues are rather difficult to obtain and are found only by laborious methods.

Obviously, the list is too extensive for detailed publication, but we would be pleased to correspond with anyone who has material which can be made available to the national collection.

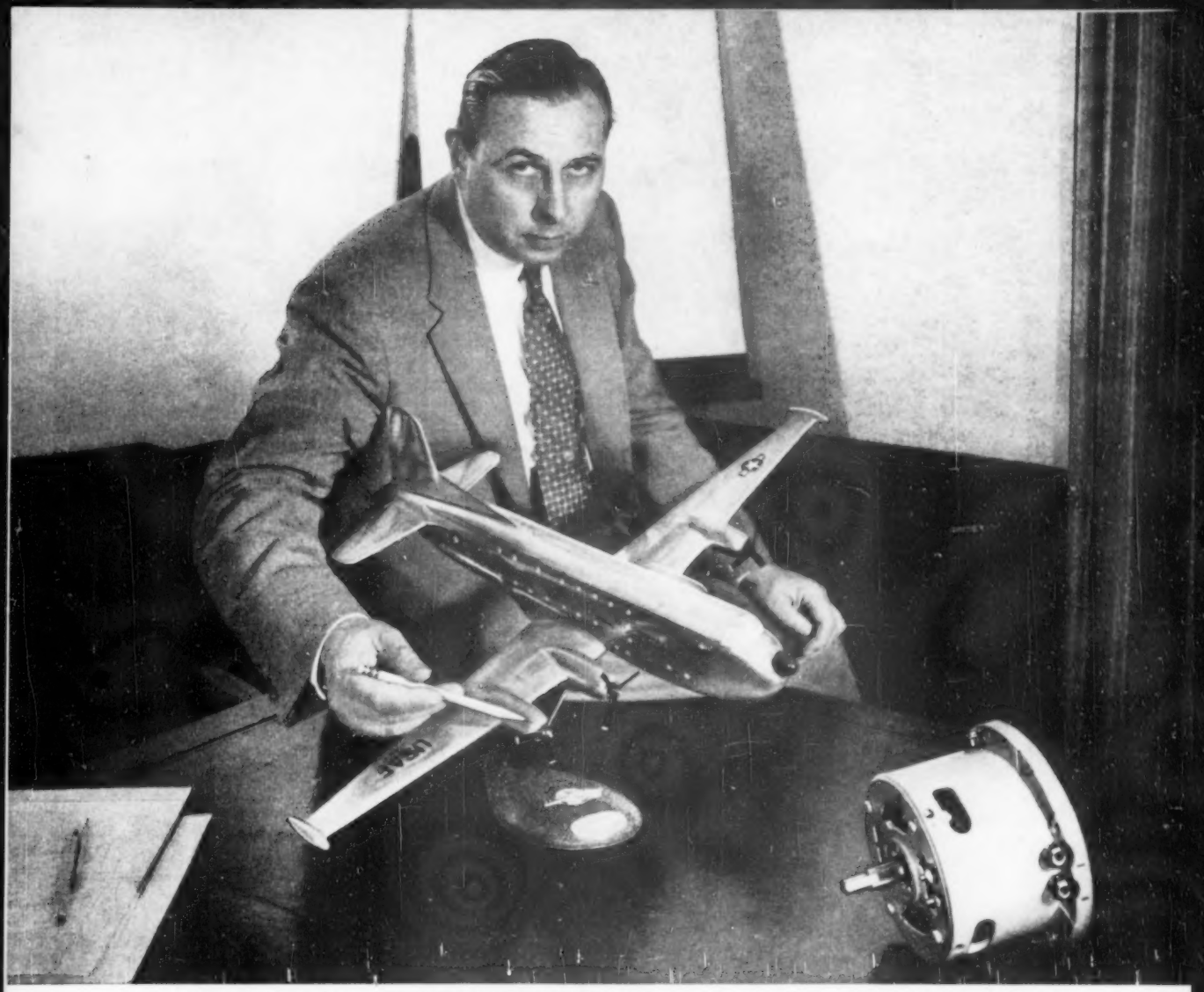
ROBERT C. STROBELL
Associate Curator
National Air Museum
Smithsonian Institution
Washington, D. C.

New Flight Recorder

In a letter published in the Oct. 25 issue of AVIATION WEEK ("Trouble Records," p. 69), Capt. Bond expressed his opinion concerning the need for a "trouble recorder" to obtain flight data on aircraft.

There is little doubt that such an instrument, if used on all aircraft, would provide invaluable information on such unexplainable aircraft mishaps as the Comet mid-air explosions, as well as aid in other mishap investigations. Such a unit could also be used to obtain data for maintenance requirements and operations analysis.

Prof. J. J. Ryan of the University of



J. L. ADRIAN, CHIEF PROPELLER DESIGN ENGINEER, PROPELLER DIVISION, CURTISS-WRIGHT CORPORATION, CALDWELL, N. J.

G-E aircraft motors meet C-W's toughest specs

"When Curtiss-Wright was developing its now famous Electric Propeller," says J. L. Adrian, Chief Propeller Design Engineer of the company's Propeller Division, "it faced very strict design requirements. For instance, C-W needed a propeller pitch-changing motor that would function with precision under the rigors of combat military service—extremes of altitude, temperature, vibration, shock, and centrifugal force.

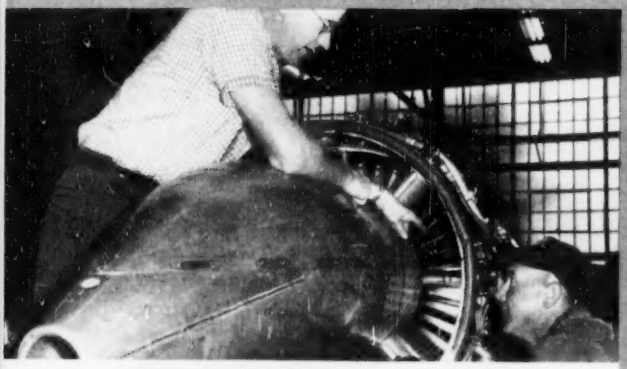
"Then G-E engineers were called in. They came through with a basic motor design that not only met Curtiss-Wright's toughest specifications but, with variations, has been used in 55 different Curtiss Propeller applications since—on such planes as the B-50 Superfortresses, C-124 Globemasters, and DC-6, CV-240, and Constellation transports."

IN SERVING YOU, G-E engineers can draw on unmatched experience gained in solving this and many hundreds of other aircraft motor problems. In addition, they'll have at their disposal complete aircraft motor development and testing facilities.

To take full advantage of this service, contact your local G-E Apparatus Sales Office *early in your planning*. And, for more information, write today to Section 704-30, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

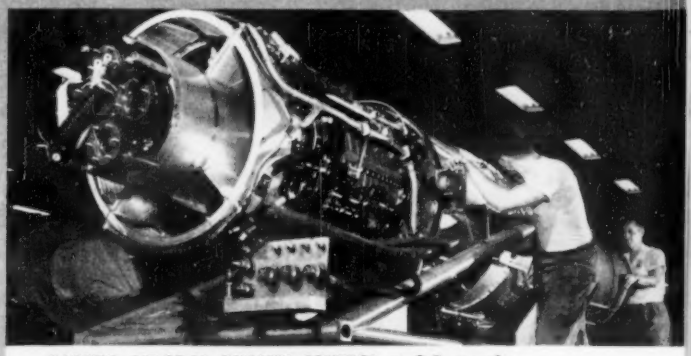
GENERAL ELECTRIC



NEW INLET GUIDE VANES allow more air to enter compressor of J47-GE-33 engine. New vanes have same configuration as those used on J47-GE-17, but pay off in increased thrust during dry and afterburner operation.

IMPROVED RELIABILITY in the J47-GE-33 engine is illustrated by the new "floating" shim shroud visible above. It reduces the possibility of shroud ring rub on turbine wheel buckets. G-E tech rep is pointing to new adjustable turbine baffle.

NEW, LARGER "EYELID" handles increased J47-GE-33 airflow. Just inside 'lid, a sturdy ceramic-coated liner acts as a radiation shield, allows higher afterburner fuel flow; also preserves boundary layer cooling of the tailpipe.



CAREFUL J47-GE-33 QUALITY CONTROL at G-E manufacturing plants is already paying dividends to the Air Force. For example, only one-out-of-four J47-GE-33's now require two tests before shipment to the USAF.

More "D" Sabre Jets are in use today than all other types of USAF interceptors combined.

Why the F-86D Sabre Jet Interceptor Now Climbs UPSTAIRS....20% FASTER!

New production model J47-GE-33 jet engine packs more thrust, also improves "D" reliability and ease-of-maintenance

For the past three years, North American Aviation's F-86D Sabre Jet has been the fastest interceptor in the Air Force's Air Defense Command (top speed: over 650 mph).

Today a new General Electric turbojet, the J47-GE-33, is being installed in "D" Sabres. The engine makes the "D" still faster . . . more reliable . . . easier to maintain.

The J47-GE-33 has the same basic design as its predecessor, the J47-GE-17. But these six improvements reduce its weight, increase its durability, and, most important, allow it to swallow more air and increase its afterburner power:

1. New inlet guide vanes
2. New capacitor discharge engine ignition system
3. New "floating" turbine wheel shim shroud
4. New Hotstreak afterburner ignition system
5. New ceramic inner-liner for afterburner
6. New larger variable area jet nozzle

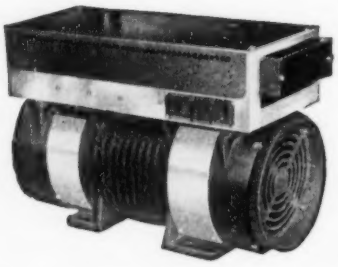
The J47-GE-33 can peel 20% off the time originally required to "scramble" an F-86D from standing start to 45,000 feet.

By helping the Air Force reduce maintenance time and costs, as well as increase jet performance, the J47-GE-33 again illustrates the G-E slogan, "Progress is our most important product." ***Section 232-3, General Electric Co., Schenectady 5, N. Y.***

Progress Is Our Most Important Product

GENERAL ELECTRIC

The most complete line of AIRCRAFT INVERTERS



Building inverters for regular and special aircraft needs is one of Bendix Red Bank's specialties. Thus, we offer the widest range of standard inverters plus the ability to design and produce all kinds of special-purpose inverters . . . including models up to 5000 VA and models for high-temperature, high-altitude applications. For complete details on inverters to meet your needs *exactly*, write Aircraft Inverter Section, Bendix Red Bank Division, Eatontown, N. J.

INVERTERS—400 CYCLE OUTPUT

Type	INPUT		OUTPUT			Approx. Weight Lbs.	Max. Alt. Feet	Designed to Government Part No.
	Volts	Amps.	Volts	Phase	VA Rating			
12128	27.5	1	26	1	6	2.2	35000	AN3496-1
12126	27.5	2	26	3	10	2.3	35000	N1020-SK
MG-93	27.5	12	115/200	1	100	10	65000	E-5134
				3	100			
MG-54	27.5	22	115/200	1	250	17	65000	E-5109
				3	250			
12142	27.5	22	115	1	250	13	35000	E-1617
				3	250			
12146-1	27.5	22	115	1	250	13	35000	53B6239
12146-2	27.5	22	115	3	250	13	35000	AN3532-2
MG-60	27.5	22	115	1	250	17	50000	53B6239
MG-62	27.5	22	115	3	250	17	50000	AN3532-2
32E01	27.5	35	115	1	500	26	50000	AN3533-1
				3	500			
32E00	27.5	37.5	115	1	500	34	50000	AN3534-1
		51.5		3	750			
MG-65	27.5	50	115/200	1	750	35	50000	E53805
		52		3	750			
1518 Mod. 1 & 2	27.5	105	115	1	1500	37.5	20000	—
		126		3	1800			
1518 Mod. 5	27.5	105	115	1	1500	37.5	35000	—
		126		3	1800			
MG-81	27.5	180	115/200	1	1600	61	65000	E1725
				3	1800			
32E06	27.5	150	115/200	1	2250	56	50000	E1725
		160		3	2500			
MG-70	27.5	170	115/200	1	2250	54	65000	—
				3	2500			
MG-61	27.5	170	115	1	2500	54	65000	53C6767
MG-64	27.5	170	115	3	2500	54	65000	—
32E03	27.5	160	115	1	2500	61	50000	53B6227
MG-95	27.5	150	115/200	1	2500	54	50000	E54807
		160		3	3000			
32E09	27.5	180	115/200	1 3	2500 3000	60	50000	—

NOTE: D.C. Input voltage shown is a nominal value of 27.5 volts, but all units are designed to operate from 26 to 29 volts. Input amperes shown are values at 27.5 volts input.

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors, AC-DC Generators, Voltage Regulators and Fractional HP D.C. Motors.

Bendix Red Bank

DIVISION OF

THE NAME Bendix AVIATION CORPORATION MEANS YOU

EATONTOWN, N. J.

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif. • Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y. Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

Minnesota, in conjunction with the Mechanical Division of General Mills, Inc., has developed a recorder for these uses.

This instrument is capable of withstanding 100G shock followed by 2,000F fire for one-half hour without destruction of the record and will continue to run for a minimum of 10 minutes in the event of power failure.

This flight recorder records airspeed, altitude, vertical acceleration and heading on an aluminum foil. The data can be analyzed directly from the foil without intermediate photographic or other processing.

This flight recorder has been flown over 2,000 hours by some of the United States airlines and has proved itself accurate, reliable, and maintenance-free.

W. R. Priedemann
Staff Assistant to Sales Manager
Mechanical Div.
General Mills, Inc.
Minneapolis, Minn.

All in Fun

On June 14 this year I visited Brussels Airport (Belgium) and was amused to see there a Beech Bonanza whose license letters are OO-FUN. The editor of your Strictly Personal column might like this.

W. R. Sears, Director
College of Engineering
Cornell University
Ithaca, N. Y.

Sabena Series

Please congratulate Bob Hotz on a magnificent series on the Sabena helicopter operations. I have heard much favorable comment and I must say Aviation Week scored a real "beat" with Hotz's writings. Thanks for a swell job, in the tradition inaugurated by George Christian last year, with an earlier series.

Stanley G. Markusen
Director of Public Relations
Sabena Belgian Air Lines
422 Madison Ave.
New York 17, N. Y.

Praise

I would like to express my appreciation of the excellent story by David Anderton on the Contraves Etos Phototheodolite, in the Sept. 13 issue. It is expertly written and sums up remarkably well the characteristics of the tracking equipment. Thank you for your excellent coverage of the product of one of our associate companies.

We would like to reprint the story—with due credit to Aviation Week—for distribution to customers and within the Oerlikon group.

Rolf Wild,
Oerlikon Took & Arms Corp.
Asheville, N. C.

With avid interest I read the story, "Martin Midget Tailored for Close Support" in the Nov. 1 Aviation Week" . . . Could you please send us 24 reprints.

W. L. Joe Bolles
Martin USA
78 Buckingham Gate
London, SW 1, England

SENIOR STAFF

at Ramo-Wooldridge

The Senior Staff of The Ramo-Wooldridge Corporation, shown above, is comprised of scientists, engineers, and science administrators with outstanding records of past performance in positions of responsibility. By means of meetings of the entire group, supplemented by frequent smaller sessions, these key men participate actively in the establishment of company plans and policies.

Existing project commitments require that the current rapid rate of expansion of the company continue throughout the coming year. Unusual opportunities, encompassing a wide variety of challenging research and development problems, exist for *additional* scientists and engineers who would like to participate in the development of a company in which, from the outset, all features of the organization and of the operational procedures are designed to be as appropriate as possible to their special needs.

1. Dr. Burton F. Miller
2. Dr. James C. Fletcher
3. Robert B. Muchmore
4. Dr. John M. Richardson
5. Dr. Howard S. Siefert
6. Robert J. Barrett, Jr.
7. William B. Hebenstreit
8. Dr. Ralph P. Johnson
9. Jack H. Irving
10. Dr. Louis G. Dunn
11. Dr. Eldred C. Nelson
12. A. J. F. Clement
13. Dr. Milton U. Clauser
14. V. G. Nielsen
15. Dr. Eugene M. Grabbe
16. Marion F. Thorne
17. Dr. Robert R. Bennett
18. Robert J. Hight
19. Dr. Andrew Vazsonyi
20. Emory Lakatos
21. Richard A. Hartley
22. Dr. Howard L. Engel
23. Dr. Donald L. Drukey

The Ramo-Wooldridge Corporation

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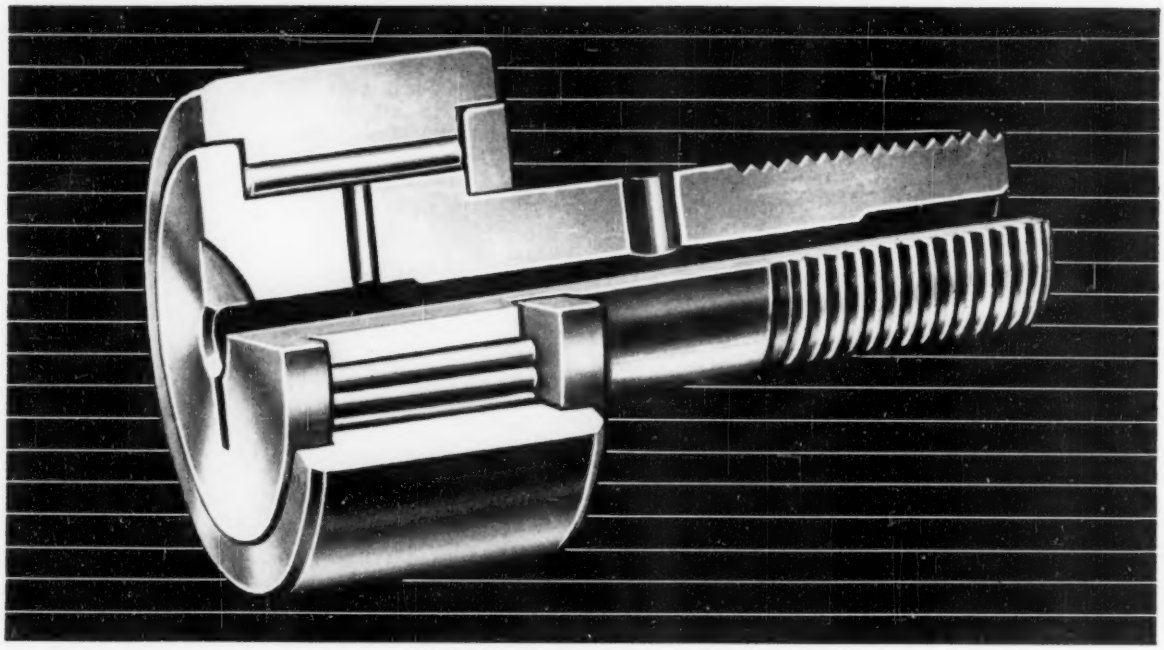
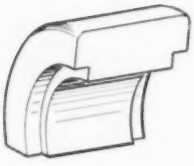
POSITIONS ARE AVAILABLE FOR SCIENTISTS AND ENGINEERS IN THESE FIELDS OF CURRENT ACTIVITY

Guided Missile Research and Development
Digital Computer Research and Development
Business Data Systems Development
Radar and Control Systems Development
Communication Systems Development



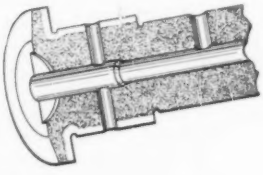
TORRINGTON CAM FOLLOWERS

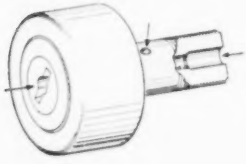
Give Longer Service . . . Carry High Shock Loads



1. Heavy sectioned outer race of hardened and ground high carbon chrome steel assures uniform distribution of high rolling and shock loads while providing high capacity anti-friction performance.

2. Integral stud for cantilever mounting is made of case hardened and ground low carbon nickel molybdenum steel. The tough core provides high strength to withstand high shock loads.

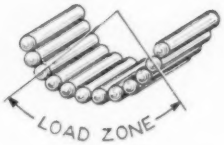


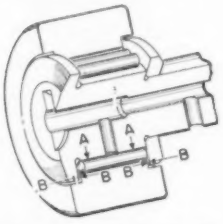


3. Easily relubricated at any one of three points—at either end or through cross hole in stud. Ends accommodate standard drive grease fittings, or may be sealed by the plugs provided.

District Offices and Distributors in Principal Cities of United States and Canada

4. Full complement of small diameter rollers—through-hardened, ground and lapped—for maximum radial load capacity.





5. Raceways precision ground for even load distribution (A) and uniform low end play (B) assure long bearing life.

Torrington Cam Followers are precision made throughout. They are available in sizes from ½" to 2¼" O.D. Special surface finishes such as chrome and cadmium plate or oxide black can be provided.

Our Engineering Department will be glad to work with you in adapting these dependable and efficient Cam Followers to your cam-controlled or track-type equipment. Torrington Cam Followers give better service because they're better made.

THE TORRINGTON COMPANY

Torrington, Conn. South Bend 21, Ind.

TORRINGTON *NEEDLE* **BEARINGS**

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

OVERSEAS SPOTLIGHT

Blame for All in Crash

LONDON

The British Colonial Office's report on the crash last March in Singapore of a BOAC Constellation finds much to be critical of. Thirty-three persons lost their lives in the crash.

The pilot is blamed for an error in judgment in touching down short of the runway at Kallang Airport. However, the fact that the captain had been on duty more than 21 hr. when the crash took place, is quoted as an extenuating circumstance. (The British Air Line Pilots Assn. recently complained that many scheduled flights call for 15 to 20 hours duty, with more if the weather is bad. Length of duty tours until now has been settled on a local basis between operators and pilots; now the association wants the government to examine the problem with a view to writing legislation setting maximum hours.)

The airport is hit as being inadequately equipped with fire and rescue services, and the recently retired director general of civil aviation at Singapore is blamed for this.

BOAC is blamed for not taking any action, although it was aware of the poor state of the airport's fire and rescue facilities. However, one of the participants in the investigation makes the claim that it is an unwritten principle that local aviation authorities, and not the airlines, are responsible for such services at airports.

Comment of the commissioner who presided at the hearings: "Big business, I know must go on. But it goes on, not only at the expense of the public, but at the hazard of their lives."

BOAC also is taken to task for the poor state of training of the crew in dealing with an unpremeditated crash.

PAA Unit to Build Hotels

ROME

Pan American World Airways' subsidiary, Intercontinental Hotels Corp., plans to build a string of hotels in Europe to accommodate the growing number of American tourists.

Topping the list of cities for which hotels are planned are London, Rome, Paris and Frankfurt. Intercontinental already has built 10 hotels in South America and has others under construction in Tokyo, Bangkok and Dahren.

Britannia to Test Radar

LONDON

Bristol Aeroplane Co. is installing terrain and weather warning radar equipment in the prototype Britannia airliner. If the installation is successful, Bristol will offer it to all customers of the Britannia; BOAC already has agreed to the installation on its Britannias, pending evaluation in the prototype.

The equipment was developed by Ekco Electronics. A 3-in. radar screen in the cockpit shows terrain obstructions and cloud formations up to 50 mi. forward. The Ekco radar operates in the X-band (3.2 cm).

Red China Five-Year Plan

Red China's Premier Chou En Lai has announced at least one aircraft plant is included among 600 large industrial projects scheduled for completion during the nation's first five-year plan, which ends in 1957.

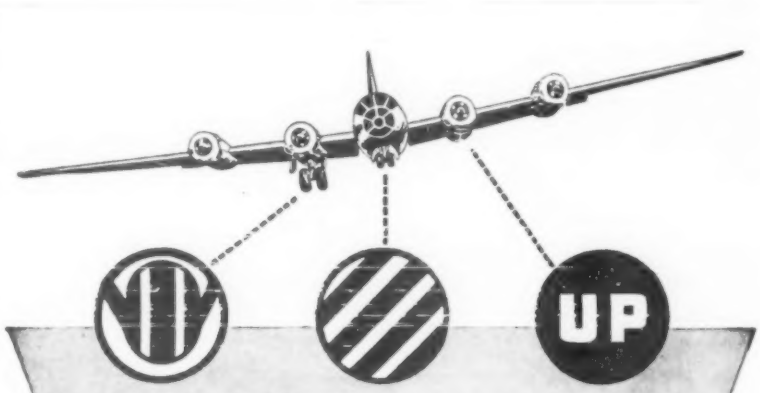
This report is from Russian press sources.

Spanish Design Cargo Plane

MADRID

A new cargo plane, powered by two 1,690-hp. Bristol Hercules piston engines, has been designed by the Spanish firm, Casa (Construcciones Aeronauticas SA). The plane has a design gross of 16,270 lb.

The same firm is building two German Dornier designs.

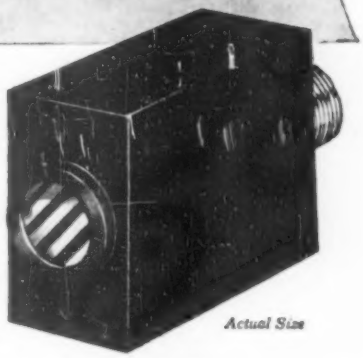


Three "pictures" tell the tale . . . Simply, Accurately!

KEYSTONE
3-POSITION INDICATOR

Requires but a Small Space —Gives a "BIG PICTURE" on Operating Conditions

The landing gear markings shown above are but *one* of *eleven* different instrument applications. Tells the story "at a glance" on *flap positions, oil pressure or temperature, fuel supply* and other operating conditions. Economical, easy-to-install in both small and large planes.


Actual Size

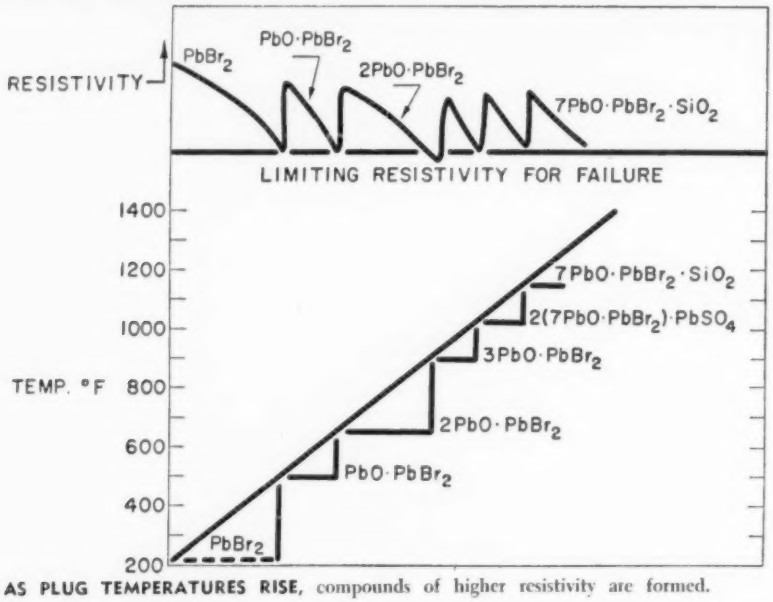
High Quality Construction

- Impervious to dust, moisture, gases
- Hermetically sealed brass case
- Filled with inert gas
- Optically clear glass window
- Corrosion resistant finish

RIVERSIDE

For additional information, write to:

KEYSTONE WATCH CASE DIVISION
RIVERSIDE METAL CO.
Riverside, New Jersey



AS PLUG TEMPERATURES RISE, compounds of higher resistivity are formed.

Gains Made Against Plug Fouling

Ethyl Corp. tells Champion meeting it has identified fouling compounds, a big step toward licking problem.

Three items shared the spotlight at the recent 1954 Aircraft Spark Plug and Ignition Conference, sponsored by the Champion Spark Plug Co. in Toledo.

• **Paper entitled "Postulated Mechanism of Spark Plug Fouling"** by Dr. Frances Lamb of the Ethyl Corp. The first woman to attend or address a Champion conference gave evidence that Ethyl Corp. had made a big step forward in identifying the materials that make up spark plug deposits and eventually foul the plugs. Such a study will make it easier to combat this problem.

• **Champion data** showing the average life of spark plugs in various makes of aircraft engines.

The conference was attended by more than 170 persons from various fields interested in ignition problems.

• **Announcement of "deglamorized" spark plug** which will save money, material and manufacturing time and costs.

▶ **Deglamorized Plug**—How does a deglamorized spark plug compare with a standard plug? Champion officials use this simile: "As a standard model automobile does the job of its de luxe counterpart with exactly the same efficiency but without a lot of trim unnecessary to its operation, so the deglamorized plug functions in an aircraft engine with performance equal to a standard plug—only without some of its frills."

Deglamorization of spark plugs has these three desirable results—it reduces plug cost and machining time and saves materials going into the plug's manufacture. By reducing cost, Champion says it is "cooperating with the Air Force to produce an economical, one-run plug."

Here is what Champion did to deglamorize its plug:

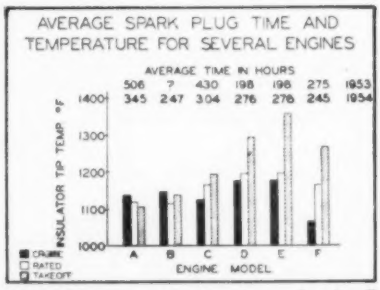
• **Gasket shoulder** diameter has been reduced to the minimum dimensions allowed by specifications. This permits body shell to be produced from $\frac{7}{8}$ in. hex stock instead of 1 in. round, eliminating milling the hex, which saves 12% of the raw steel going into the plug.

• **Zinc plating** on body exterior has been eliminated in favor of enamel paint.

• **Glaze on inner bore** of terminal connector well has been eliminated.

• **Solid copper gasket** has been replaced with a three-fold copper gasket which was developed as the result of a cooperative effort by Champion and McChord Field. The new type gasket saves 50% of the raw copper formerly required for and costs less than solid gaskets.

Champion did not reveal how cost of the deglamorized plug would compare with conventional units.



PLUG LIFE is cut if cruise and takeoff temperatures differ much, Champion says.

▶ **Postulated Mechanism**—Dr. Lamb's paper explained that identification of spark plug deposits "has supplied the key to how deposits affect spark plug operation."

An extensive research program has been undertaken by Ethyl Corp. to determine how engine deposit compounds are formed, what their thermal and electrical properties are and how they may be modified.

The program involved identifying by X-ray diffraction almost 100 typical deposit-compounds which had been prepared in the laboratory. These compounds were then analyzed for their thermal and other physical properties. Simultaneously, hundreds of plugs underwent controlled engine tests and their deposits were examined.

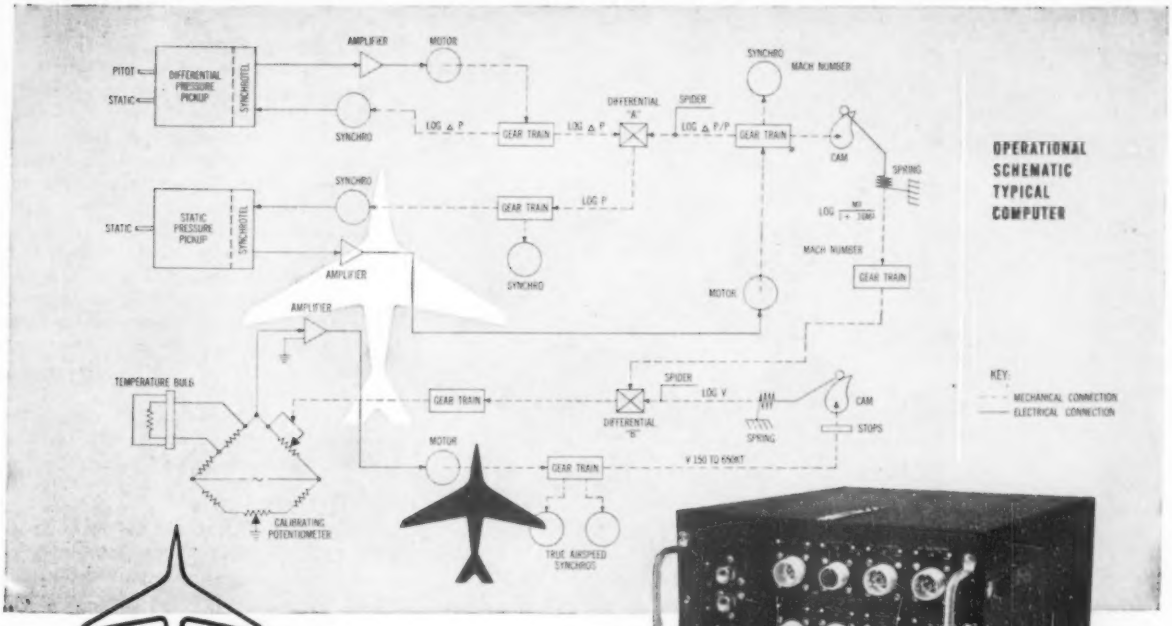
Previous attempts to establish the mechanism of spark plug fouling have been handicapped by lack of information on the composition and properties of deposit-compounds.

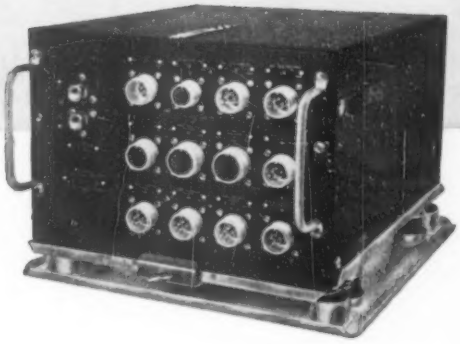
Dr. Lamb explained the results of her studies this way: As plug temperature rises (insulator tip temperature rises from 650 to 1,350F in 20 seconds in a modern V8 automotive engine when the car is rapidly accelerated), compounds on the plug react in the solid state with each other and with products of combustion to form new compounds of higher melting point and higher electrical resistivity.

Engine tests with thermal plugs show that the three main factors influencing compounds formed in the engine are temperature of the collecting surface, fuel/air ratio used in the engine, and relative concentration of fuel additives.

Dr. Lamb concluded: "The mechanism of spark plug fouling can be explained by the relationship of compound composition and of electrical resistivity to temperature. If an engine is accelerated rapidly . . . the sudden increase in insulator temperature causes the electrical resistance of the existing compounds to fall below the critical value and produce mis-fire before there has been time for the next higher melting and more resistant compound to form."

▶ **Engines & Plugs**—In 1953, Champion advanced the theory that the life of a spark plug in particular engine varied





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Kollsman electromechanical Computers are being used in autopilots; photographic, bombing and fire control systems; navigation equipment—some in conjunction with radar. They can be designed to perform functions which are virtually unlimited in scope.

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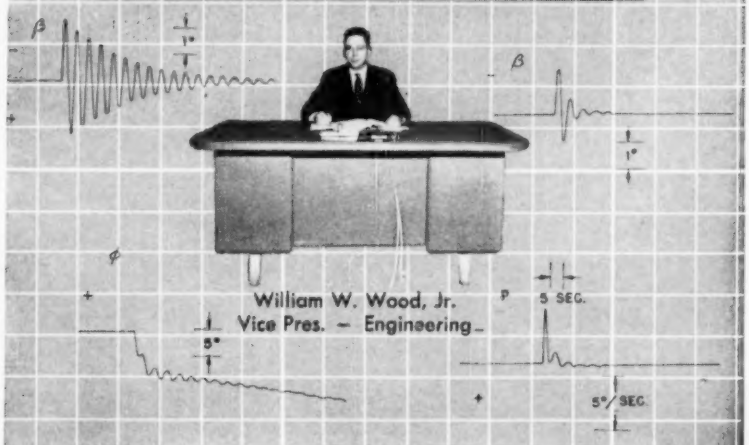
SOME STRAIGHT TALK TO ELECTRONIC ENGINEERS



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if you'd like to set up an exploratory interview.

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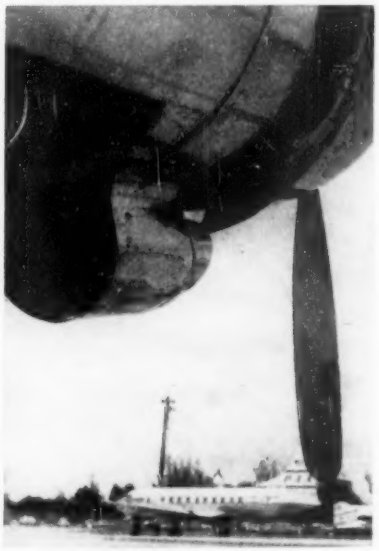
according to the relationship of the plug's temperature at cruise and at takeoff among other things. The company showed a chart to substantiate its reasoning. On the chart were six engines, labeled "A" through "F"—they were not further identified. Under each engine was plotted a triple bar graph showing spark plug temperatures under the power conditions of takeoff, rated and cruise.

From this chart, it was evident that a relationship exists between spark plug life and its temperatures at takeoff and cruise for any given engine—the greater the difference in the takeoff and cruise temperatures, the shorter the plug's life.

This year, Champion brought the chart up to date, using data received from the many airlines using its spark plugs.

R. K. Christie, Champion's director of research, had this to say on the subject: ". . . Many factors are involved in determining the time a spark plug can be used. We have in past years advanced the theory that the relation-

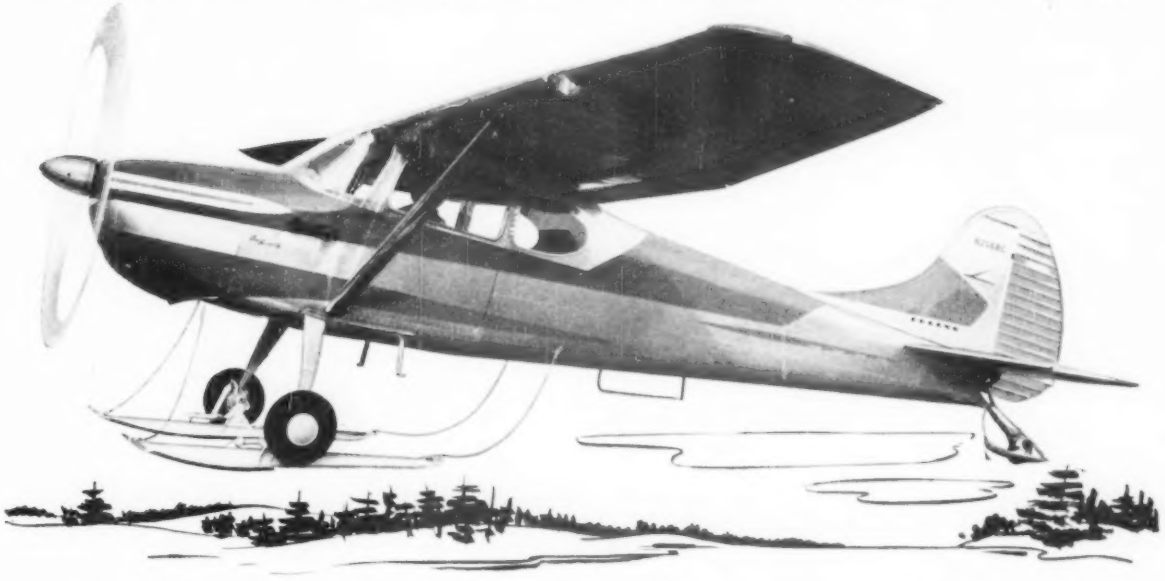


Hi-Per DC-3 Closeup

All-stainless steel accessory cowling and AiResearch oil cooler on Pan American World Airways' Hi-Per DC-3 are shown above. PanAm gave the "old workhorse" a 500-hp. shot in the arm—250 hp. in each engine—by replacing its 1,200-hp. R1830s with 1,450-hp. R2000 powerplants (Aviation Week, Nov. 1, p. 70). The R2000s give the DC-3s performance comparable to DC-4s, PAA says. The Hi-Per DC-3 grosses out at 26,900 lb., a 1,528-lb. payload increase over the former limit of 25,200 lb., after deducting modification weight increases. Civil Aeronautics Administration has approved the conversion. Modification is available on contract from PanAm at Miami.

NEW FEDERAL "LDR" SKI BOTTOMS

insure normal take-off performance under every snow condition



Enjoy the Convenience of Fixed Base Facilities with the Utility for Reaching the Most Remote Areas with Federal Combination Wheel-Skis.

PERFORMANCE PROVED BY CANADIAN BUSH OPERATORS... READ WHAT ONE OPERATOR SAYS

ONTARIO CENTRAL AIRLINES LIMITED

July 9, 1954.

Mr. C. D. Drever, Field Engineer,
Federal Aircraft Works,
3456 North Mississippi Drive,
Minneapolis 12, Minn.

Dear Sir:

We take great pleasure in submitting to your office, a pod ski-mounted on one of our aircraft.

While we have not compiled an exact figure, of the number of take-offs and landings on this specific aircraft, we would estimate it at 200 take-offs and 200 landings, while this ski arrangement was installed.

This operation was conducted throughout a variety of snow conditions and loads. Temperatures ranged from +30° to -25°, and very little difference in performance was noticed, throughout these temperature ranges. During this operational period, all types of snow were encountered, including a 20" wet snow fall, which usually gives extremely sticky conditions. Also, a ragged glare ice condition, which was very jagged and rough, which would normally completely damage the wood runners on a wooden ski. This condition developed, from a cold snap, after a very heavy thaw.

During the latter part of the spring operation, we had a very mild day, and our parking area was extremely flooded. That night, the weather situation changed, and went to 10° below zero, and all the aircraft in the parking area, were frozen into the ice. In the case of the Bushmaster ski installation, it was merely necessary to clear off the ice that had formed over the ski, and then the aircraft was free to pull out under its own power. However, the conventional ski bottoms were frozen in all supporting surfaces, and breaking them loose, involved a major operation.

It is our sincere opinion, that if an application for this type of ski could be made to our fleet of larger aircraft, that we could greatly reduce our winter operational costs, and bring them in line with a summer operation.

Yours very truly,
ONTARIO CENTRAL AIRLINES LTD.
O. Batson
Manager

RECEIVED
JUL 10 1954
Federal Aircraft Works

FROM THE SOUTH TO THE NORTH ITS "O.C.A."

Federal skis with new high performance "LDR" bottoms provide uniform snow operations normally associated with wheel performance. Federal Wheel-Skis with pilot selective control give greater utilization, safety, convenience and economy. Now the world's most dependable and ruggedly built ski has even better performance with the new Federal "LDR" ski bottom. There is a Federal Combination Wheel-Ski or Wheel-Replacement Ski model for nearly every type and class of aircraft. Federal Wheel-Skis provide multi-purpose landing gear.

NEW FEDERAL "LDR" SKI BOTTOMS HAVE A PROVEN RECORD OF PERFORMANCE

The most adverse flight conditions encountered are those which challenge Canadian and far north bush operators. Federal "Alcan-Bushmaster" skis with "LDR" bottoms have been proven to have outstanding free sliding take-off and landing characteristics. Under the severe conditions of "sticky snow," "frosty snow," "sand snow" and "slush," "LDR" eliminates "freeze down" and "sticking."

ATTENTION! FEDERAL SKI OWNERS!

Federal "LDR" ski bottom surfaces can be readily installed on your present skis. Modernize with a Federal pre-formed "LDR" Bottom Conversion Kit. Enjoy unexcelled ski performance with greater efficiency, less maintenance and increased economy.

Your nearest Federal distributor will give you complete information about this newest development in aircraft skis. Contact him or write Federal Aircraft for the name of your nearest supplier.

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ship at cruise and takeoff is a factor of prime importance. . . . This theory still appears valid for all engines except the Wright Turbo Compound, in which one of the limiting factors is electrode life. Electrode temperatures, and specifically, ground electrode temperatures, in the Turbo Compound engine are appreciably higher than those involved in any other current commercial engine."

Other Subjects—Among other subjects discussed were Shell Oil's anti-fouling additive, TCP (tricresyl phosphate). Some spoke of it as being almost indespensable—others said no.

Vapor Blast Manufacturing Co. described an improved version of its liquid abrasive cleaner, discussed at the 1953 meeting.

One observer had this to say about the conference: "It permitted a more leisurely and thorough discussion of spark plug problems, largely because ignition problems, as such, had received a thorough going over at the recent Bendix-Scintilla meeting."—GLC

Vickers Develops New Two-in-One Valve

A new series of space-saving, double-acting hydraulic system relief valves which reduce number of pressure connections up to 85% has been developed by Vickers, Inc. The new valves combine conventional check valves with four poppet-type check valves built in a single housing.

The units require only four pressure connections instead of up to 28 for conventional combinations of one relief valve and four separate check valves.

The lightweight valves have a special port in the housing to permit venting of the hydraulic system, and an external lever control which can block the relief valve to permit momentary hydraulic system pressure overloads for emergency operations.

The combination valves, labeled series AA-31350, come either with tapped pressure connections or with "O"-ring sealed, flange-type mountings. The valves are adjustable to relieve within the range of 900-4,100 psi. cracking pressure.

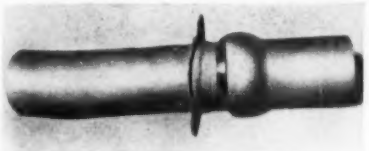
DC-4 Exhaust Units Life Span Doubled

A method of doubling the life of exhaust system ball joint assemblies for DC-4 aircraft has been developed by Ledkote Products' Aircraft division, and is being used by Pan-American, TWA and Capital, among other airlines. The company has also developed a similar procedure for Constellation-type aircraft.

Ledkote says its method stretches the ball joint's normal one-run life to two engine runs. This is how the process works:

- **Ball joint** is completely stripped and corrosive scale removed.
- **Spherical surfaces** of the ball joint component are refinished.
- **New high-temperature stainless** steel sleeve assembles are installed.

Ledkote Products, Inc., 35-01 Vernon Blvd., Long Island City 6, N. Y.



RECONDITIONED joint assembly after being stripped, descaled, refinished, and fitted with stainless steel sleeve.

ASSEMBLY before Ledkote rejuvenations.

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- **Simple, fool-proof operation** — a single wire centered in thermistor material with a grounded outer sheath — temperature sensitive at all points.
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- **Adds almost negligible weight** — the control assembly tips the scale at only .8 pound—100 feet of sensing cable, at 1 pound.
- **Low impedance design** — to eliminate completely false alarms due to moisture or capacitive effects.
- **Responds within seconds** — signals "Fire Out" automatically — and responds repeatedly to fire exposure.
- **Exclusive snap clamps** — to allow simple installation — speed maintenance.
- **Varying temperature alarm points** — from the same detector circuit within a single cable loop — guarantees maximum sensitivity for each area guarded.
- **Vibration and shock resistant** — because there are no moving parts — no ceramic to crack in the easily flexed cable.

Won't you write us for complete data on this revolutionary development?

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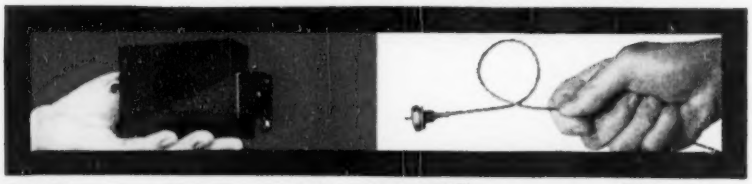

Thomas A. Edison, Inc.

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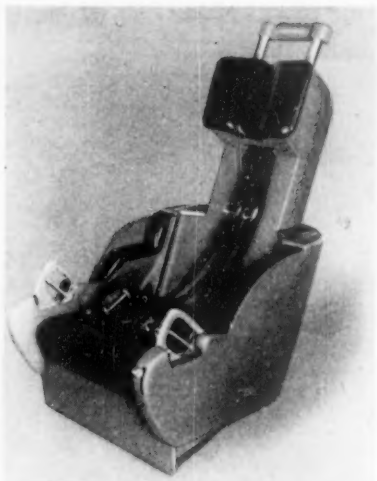

SACSEAT cannot be triggered until canopy-jettison handgrip is raised.

Convair Makes Safer Ejection Seat

A safer and more comfortable ejection seat for highspeed aircraft has been developed by Convair, Fort Worth.

Convair cites these features of its new, upward-ejecting seat (labeled "SACseat"):

- **Trigger cannot be fired** until handgrip, which jettisons the canopy, has been raised.
- **Dual handgrips and triggers** allow crewman to eject with either or both hands.
- **Ejection may be accomplished** with the seat in any position by using only hand and forearm—important in case high G forces or injuries hamper the crewman.
- **Forearm guards** and ejection handgrips keep crewman fully cradled within the seat during ejection, eliminating the possibility of his striking parts of the plane on his way out.
- **Full-width, telescoping skirt** has replaced "stirrups" used on other ejection seats. The skirt keeps the crewman's legs from being blown under the seat upon ejection, thus prevents possible leg, ankle and foot injury.
- **30% more hip room (22 in.)** has been provided in the SACseat than in conventional seats, although arm rests are 19 in. apart.
- **Padded and cradled headrest** provides maximum protection during ejection from aircraft.
- **Narrow back** makes it easy for a crewman to reach equipment beside or behind him.

The SACseat was designed to meet all military structural requirements. The seat is adaptable to all methods of takeoff—conventional, catapult or vertical.

MAN BEHIND THE C-119

Berlin or Bombay . . . Nome or New Guinea . . . wherever the *Flying Boxcar* is based, there's a Fairchild field representative on the job. These men and the versatile military air transports they tend are serving all over the world, in every type of climate, under the most difficult operating conditions.

As Fairchild trouble-shooters, these expertly trained technicians work closely with U. S. Air Force and Navy engineering officers and men, keeping the Fairchild C-119 operating at maximum efficiency.

Fairchild is proud of these men, the combat-proven *Flying Boxcar*, and the important part both play in the defense of free men everywhere.

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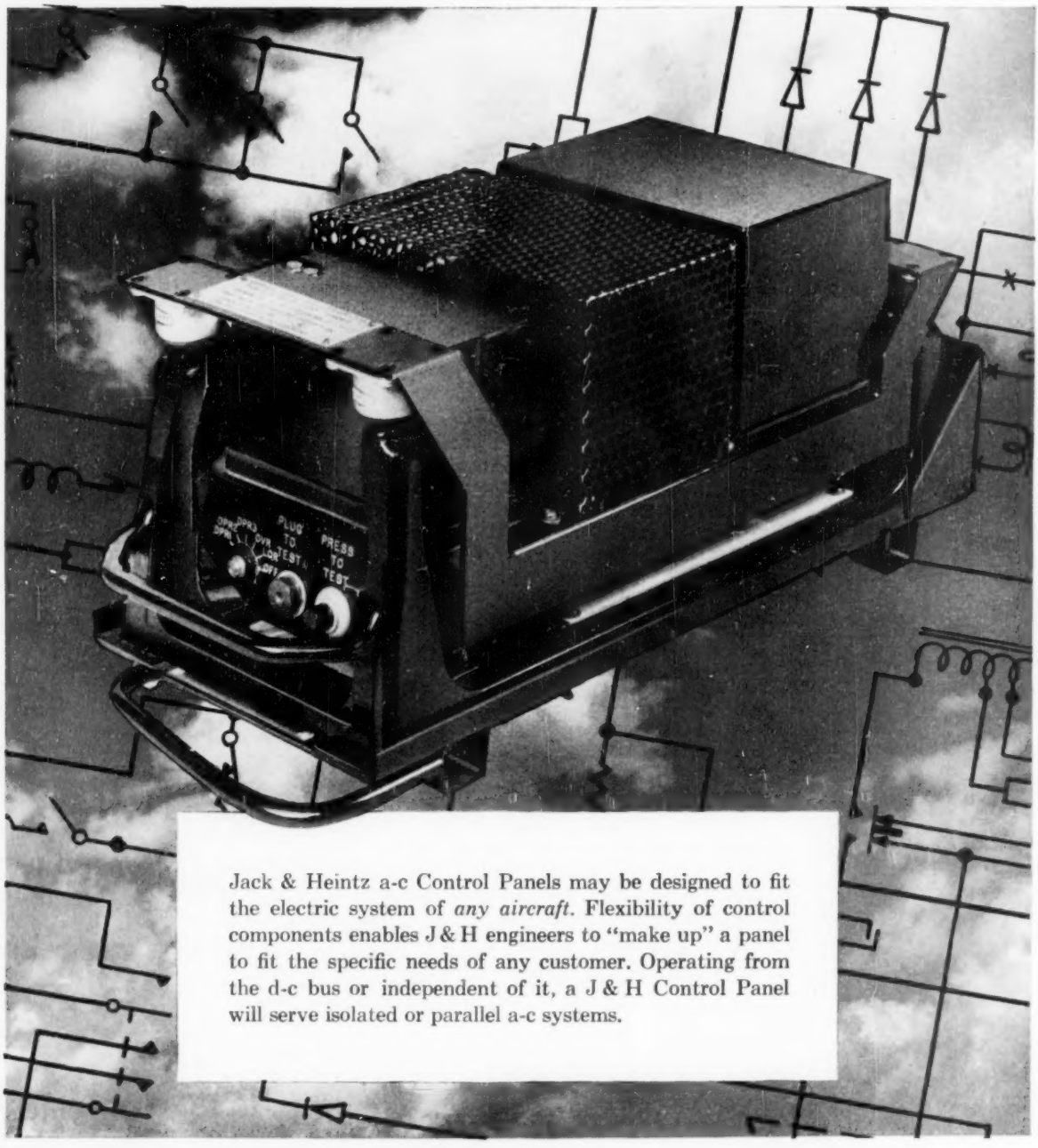
Enlist to fly in the U. S. Air Force

A-C CONTROL PANELS...

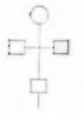


Jack & Heintz a-c Control Panels may be designed to fit the electric system of *any aircraft*. Flexibility of control components enables J & H engineers to "make up" a panel to fit the specific needs of any customer. Operating from the d-c bus or independent of it, a J & H Control Panel will serve isolated or parallel a-c systems.

JACK & HEINTZ *Rotomotive*

a report from JACK & HEINTZ

J&H Tailors Panels to Specific Customer Needs



Designed to meet applicable USAF and USN specifications, J&H Control Panels can include any of the features listed below. Typical of many unique J&H control elements is the new overvoltage relay. This unit is designed to be insensitive to acceleration forces. All panel functions can be supplied as individual components.

Other a-c equipment: J & H has developed other major components of the a-c system, including: air-cooled, liquid-cooled and vapor-cooled generators; static-magnetic-amplifier type regulators; and balanced, rotary latch circuit breakers. Auxiliary components include: transformers, reverse power relays, phase sequence relays and others.

JACK & HEINTZ A-C CONTROL PANELS

J&H PART NUMBER	GC88-1	GC100	GC102	GC105	GC112	GC127-1	GC127-2	✓
Specification	WCLEE1-28	WCLEE1-22	WCLEE1-35	WCLEE1-37	WCLEE1-27	J & H	J & H	☐
Single or Three Phase	Three	Three	Three	Three	Three	Three	Three	☐
Voltage	115/200	115/200	115/200	115/200	115/200	115/200	115/200	☐
Frequency (cps)	380/420	320/1200	380/420	380/420	380/420	380/420	380/420	☐
Isolated or Paralleled System	Both	Isolated	Isolated	Isolated	Both	Isolated	Isolated	☐
Differential Current Fault Protection	Yes	Yes	Yes	Yes	Yes			☐
Underspeed Protection	Yes						Yes	☐
Phase Sequence Protection	Yes						Yes	☐
Open Phase Protection								☐
Generator Control Relay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	☐
GCR Anti-Cycle	Yes	Yes	Yes	Yes	Yes	Yes	Yes	☐
Overvoltage Protection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	☐
Overvoltage Lockout		Yes		Yes	Yes			☐
Undervoltage Relay	Yes			Yes		Yes	Yes	☐
Over or Under Excitation Protection	Both				Over			☐
Field Flashing		Yes	Yes	Yes	Yes	Yes	Yes	☐
Power Indication Relay Function		Yes	Yes	Yes	Yes	Yes	Yes	☐
Transformer—Rectifier Unit		Yes		Yes	Yes			☐
D-C Control Power Transfer		Yes		Yes	Yes	Yes	Yes	☐
Lockout Relay (Manual Reset)		Yes		Yes	Yes	Yes	Yes	☐
Electric or Manual Reset	Electric	Both	Electric	Electric	Electric	Electric	Electric	☐
Remote Trip	Yes	Yes	Yes	Yes	Yes	Yes	Yes	☐
Outline Dimension (L x W x H)	14x6x4.18	15.71x6x6	9.07x6.38x3.3	11.81x7x5.5	11.81x7x5.5	11.31x7x5.5	10.81x7x5.5	☐
Weight (Lb)	9	10.5	6	8	8	7.5	7.0	☐
Inject-Eject Mounting Tray	Yes	Yes						☐
Bolt Down Mounting			Yes	Yes	Yes	Yes	Yes	☐
Vibration Isolators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	☐
Your Own Special Function or Need								☐

✓ YOUR CONTROL PANEL—In right-hand column, check features you want in a control panel. Add your own special function or need on the bottom line. Jack & Heintz can design and produce your special control panel, components or a complete a-c system. We invite your inquiry. Write Jack & Heintz, Inc., 17633 Broadway, Cleveland 1, Ohio.

Military specification numbers as used herein are for purposes of product identification only and do not necessarily imply specification conformity.

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P.O. Box 1468, Pittsburgh 30, Pa.

OFF THE LINE

San Francisco International Airport has plans to attract more private planes, Frederic B. Butler, airport manager, reveals. He proposes leasing airport land to a private company which would build and operate a $500,000 maintenance hangar for private aircraft. The city would subsidize the venture. Butler says the airport should compete for private plane business—most of which now goes to Oakland, where there are maintenance facilities for private craft. He says the proposed project is now in the exploration stage; no official action has been taken as yet.

First European installation of LP-Gas for automotive use was recently completed in Holland by KLM Royal Dutch Airlines. LP-Gas, a liquefied petroleum fuel, will be used to service KLM's entire fleet of ground automotive equipment, according to the supplier, American Liquid Gas Corp., 1109 Santa Fe Ave., Los Angeles. Lockheed Aircraft Corp at Burbank, another LP-Gas user, reports big savings in fuel, oil and maintenance, says American.

Sperry engine ignition analyzers are going to Lockheed-Burbank for installation in the 20 Model 1049C Super Connies being built for TWA. Sperry specialists currently are giving TWA flight crews full instructions on use of the instrument. Cost, including installation, maintenance and flight engineer training, will total $110,000 for the fleet, TWA estimates.

Long Arrow

This 140-ft. directional arrow, pointing to magnetic north, can be seen from altitudes up to 20,000 ft., according to Esso Standard Oil Co. The petroleum company had the arrow painted on a floating steel roof that covers 42 million gal. of home-heating oil stored in a reservoir fashioned out of an abandoned slate quarry. Location is 10 miles northwest of Easton, Pa., on the heavily traveled aerial routes between New York and such cities as Pittsburgh and Cleveland.

Every 10 subscriber copies deliver 14 readers who really read

That's more than 66,000 bona-fide readers for a typical issue of AVIATION WEEK* . . . 1.4 readers per copy who passed a stiff recognition test . . . *readers who can prove they really read!*

Advertising Research Foundation uncovered this fact and a host of others about how AVIATION WEEK is read – how editorial material is read – how advertisements are read – how readers influence purchasing – in Study Number Six, The Continuing Study of Business Papers, just released. Together they make up one of the most impressive stories ever told about readership in the aviation industry.

This study was conducted by Advertising Research Foundation, because of its industry-wide importance, on behalf of some 190 leading advertisers, agencies and media – including the American Association of Advertising Agencies and the Association of National Advertisers – which compose the Foundation's membership. Findings were secured through methods developed and tested by ARF during two years of experimental research and used in actual studies of five other leading business publications. Because of these painstaking procedures and their absolute freedom from bias, Advertising Research Foundation studies are considered to be the most valuable research on magazine readership available today.

Your AVIATION WEEK representative will be glad to give you full details.

*Paid circulation of the issue studied by ARF (April 5, 1954) was 47,375. Paid circulation of current issues exceeds 50,000, on this same basis delivering *more than 70,000 readers who really read!*

AVIATION WEEK

A McGRAW-HILL PUBLICATION

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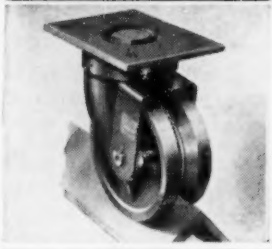
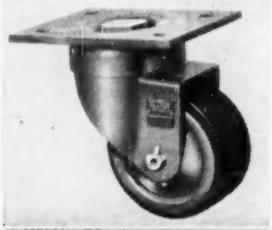
Rugged Stability!
helps you cut Costs

DARNELL





CASTERS

RUBBER TREADS . . . a wide choice of treads suited to all types of floors, including Darnelloprene oil, water and chemical-resistant treads, make Darnell Casters and Wheels highly adapted to rough usage.

RUST-PROOFED . . . by the Udylite process. Darnell Casters give longer, care-free life wherever water, steam and corroding chemicals are freely used.

STRING GUARDS . . . Even though string and ravelings may wind around the hub, these string guards insure easy rolling at all times.

LUBRICATION . . . all swivel and wheel bearings are factory packed with a high quality grease that "stands up" under attack by heat and water. Zerk fittings are provided for quick grease-gun lubrication.

DARNELL CASTERS & WHEELS

Always SWIVEL and ROLL

DARNELL CORPORATION, LTD.

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NEW AVIATION PRODUCTS

ALUMINUM PALLET for airfreight can be picked up by any of four sides by fork-lift.

New Box Speeds Cargo Handling

Commercial and military cargo operators, looking for new ways to package airborne cargos effectively for speedier plane loading, are being offered an ingeniously designed, lightweight pallet-container planned for "indefinite reusability."

The new pallet was originally designed to meet U. S. Air Force requirements and was initially displayed at a meeting of the National Security Industrial Assn. at Sewart AFB, Tenn., and has been on exhibit at Ent AFB, Colorado Springs, Col.

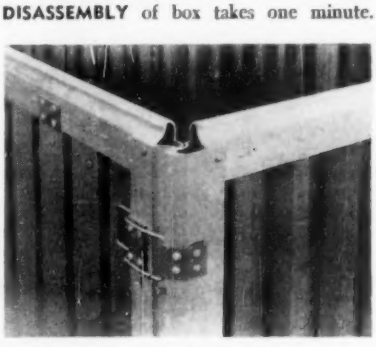
The cargo pallet was designed by Kaiser Aluminum & Chemical Corp.'s Product Development Dept., which holds the patent rights. The prototype container was built by Hart Metal Products Corp., Elkhart, Ind.

▶**Meets USAF Specs**—The product meets the following USAF requirements:

- Dimensions of 40x40x48 in.
- Indefinite reusability.
- Collapsible construction.
- Four-way fork truck entry.
- Easy tie-down.
- Load capacity of 17 lb./cu. ft., or a working load of 800 lb.
- Safety factor of 1,500 lb.
- Ability to be stacked two-high in cargo planes, three-high in storage before shipment.

▶**How It Is Made**—The Kaiser Aluminum pallet weighs 65 lb. and can be assembled or taken apart without the use of tools or loose fasteners in about one minute. Density ratio assembled-to-collapse is one-to-five.

DISASSEMBLY of box takes one minute.



CLIPS require no tools to fasten.

Six corrugated aluminum panels make up each pallet-container, each panel framed with extruded channels which enclose the sheet and are stapled to it. Lips on the channel of adjacent panels

SUPERIOR SOLID PROPELLANTS for ROCKETS...

...through DEVELOPMENTAL TESTING

Developmental testing of power units is necessary for the production of superior solid propellant rocket motors. The Thiokol Chemical Corporation conducts an intensive test program prior to production of prototypes to insure optimum performance characteristics.

Intensive tests of the type illustrated here have resulted in simplified solid propellant power units suitable for field use. They offer the designer a wide degree of flexibility in missile design. Their versatility is such that types are available to meet widely varied performance requirements. "Thiokol" solid propellants maintain a high standard of performance throughout a broad temperature range.

Intensive testing is only one of the many steps in Thiokol's integrated development of solid propellant power units. Other Thiokol activities of equal importance include chemical research, design, fabrication and manufacture.

Solid Propellant Propulsion and Power Units for:

ORD ROCKETS • GUIDED MISSILES
BOOSTERS • GAS GENERATORS
AIRCRAFT ASSIST TAKE-OFF
SHORT DURATION POWER PLANTS

We welcome employment inquiries from engineers interested in the field of rocketry.

Thiokol® Chemical Corporation

SYNTHETIC RUBBERS • PLASTICIZERS • CHEMICALS • SOLID PROPELLANTS

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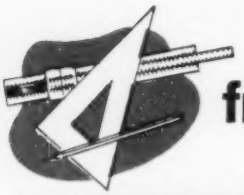


from initial design . .

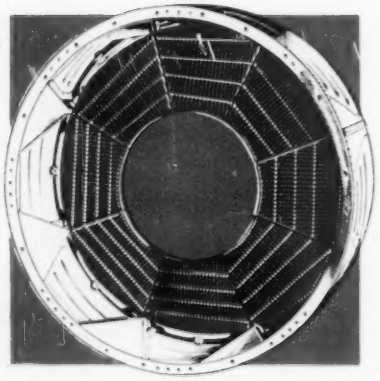
through production line . . .

SMITH-MORRIS all the way

Retractable

AIR INTAKE SCREEN

Specifically designed and manufactured for axial flow compressor gas turbines . . . Hydraulic actuation system contained within the screen housing . . . Strict adherence to AN standards and aircraft quality throughout.



SMITH-MORRIS CORPORATION

PRECISION AIRCRAFT COMPONENTS

FERNDALE 20, MICHIGAN

mesh or "cam hinge" together.

Body is 6061-T6 Kaiser Aluminum alloy except for stainless steel retaining clips. The bottom panel is 0.032 in. thick and the sides and top are 0.025 in. thick.

The bottom and top panels have cast-aluminum triple-duty cleats fastened to the corners. These cleats hold the box off the floor for fork truck entry, act as closures for the ends of the extruded cam hinges providing shear ties between panels, and serve as tiedown eyes. They are also designed to allow nesting of the collapsed as well as loaded containers. When the pallet is collapsed the five panels are placed flat on the bottom section.

Stacked, one pallet is about 9.75 in. high; subsequent stacking of pallets adds about 7.75 in. per pallet to the overall height of the bundle.

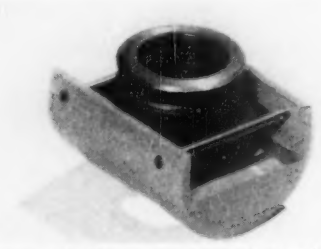
► **Assembly**—The box is assembled by cam hinging the sides and ends to the bottom and swinging them up. The top is hinged to one end and folded down like a lid.

Top and sides are fastened by two hand-operated clips, so that either the top or side panel can be hinged out for loading in either direction.

New Plane Fasteners For Variety of Tasks

A compact self-aligning barrel nut for aircraft that combines light weight, high strength and a self-locking feature is one of several new developments announced by fastener and nut manufacturers. The nut, produced by Shur-Lok Corp., is designed for applications where highly concentrated loads are encountered, such as engine mounts and wing joints.

Shur-Lok says the new nut, series SL15, weighs two-fifths less than standard barrel nuts. It is made in four pieces: an aluminum barrel, a threaded



HIGH LOADS are specialty of SL 15 nut.

steel bushing, and two steel pins. The length of the nut is slotted. The two pins go across the slotted area and hold the steel bushing in the slot, giving the self-aligning feature. This is said to assure easy mating and prevent cross-threading.

The load carried by the threads of

The plant with a one-track mind...

Actually Twin Coach Aircraft Division is five plants—each devoted *exclusively* to aircraft production. We do no other work; we build no other products.

Here's why this is important. It means your airframe assemblies are built by experienced aircraft specialists . . . men who know no other standards than those of the aircraft industry.

So if you have an assembly you're thinking of subcontracting, call in Twin Coach Aircraft Division for consultation. You'll be secure in the knowledge that it's built by men who think like you . . . men whose one thought is to produce to specification and on schedule.

The five plants comprising the Twin Coach Aircraft Division have over 3200 employees, over half a million square feet of manufacturing area, and cover 23½ acres at the Municipal Airport, Buffalo, New York.

A-9451

OTHER DIVISIONS OF TWIN COACH COMPANY MAKE:
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FAGEOL TWIN COACH AIRCRAFT

TWIN COACH COMPANY
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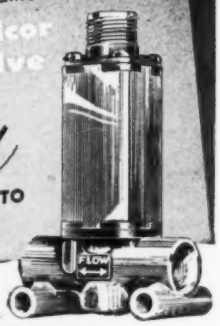
TWIN COACH AIRCRAFT DIVISION MAKES ASSEMBLIES FOR GRUMMAN S2F AND UF, BOEING B-52, PIASECKI HUP, REPUBLIC F-84F, AND CLASSIFIED EXPERIMENTAL AIRCRAFT TYPES

From the drawing boards that engineered the famous V-200-12A

a new Valcor Solenoid Valve

lighter IN RELATION TO FLOW

than any other Solenoid Valve made



WEIGHT .33 lbs.

USES
Auxiliary Power Units
Fuel Systems
Deicing Systems
Water Injection Systems

The new VALCOR V-3900 is unique. The exceptional operating advantages of the VALCOR *floating seal* design has been improved even further—

New ruggedness at ½ the weight
New compactness at ½ the weight
New dependability at ½ the weight.
Yet the same flow capacity as the V-200-12A.

This remarkable achievement means a greater freedom of design for the engineer than ever before. The VALCOR V-3900 is setting new standards of Solenoid Valve performance where low pressure drop and lightweight are a factor.

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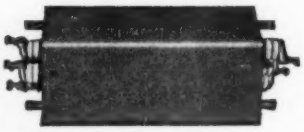
VALCOR SOLENOID VALVES

VALCOR ENGINEERING CORP., CARNEGIE AVE., KENILWORTH, N. J.

FOR MILITARY

Acme ACME Electric

OR AVIATION APPLICATIONS



All the experience of 35 years of transformer building is now available to west coast buyers of electronic and MIL-T-27 transformers thru our west coast engineering laboratories. Adequate facilities for designing quality transformers are available on your requirements.

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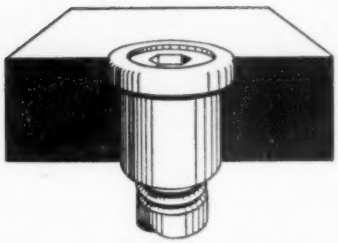
Acme ACME Electric
TRANSFORMERS



HEAT can be handled by SL 1029.

the bushings are distributed into the surrounding structure. Internal thread sizes available are 4-28 to ½-12.

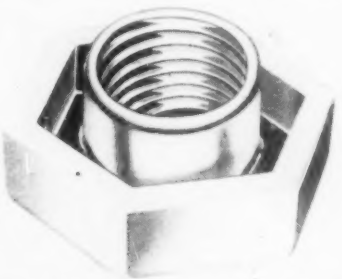
Shur-Lok has also come up with a specialty fastener, the SL 1029 overheat switch insulator self-locking nut, that is designed for high-temperature applications.

The two-piece assembly has a ceramic-coated cap and a self-locking insert pressed into the cap. It is supposed to withstand temperatures up to 1,500F.

Shur-Lok's address: 9010 Bellanca Ave., Los Angeles 45.

The new Kaylock lightweight hex nut is said by its maker, Kaynar Co., to have the highest axial strength of any comparable unit.

The new hex unit is made of cadmium-plated spring steel. Locking is accomplished by making the upper threads elliptical and highly resilient, eliminating the need for an auxiliary locking device. The nut is said to exceed BuAer and USAF specifications for the AN 363 high-temperature and AN 365 standard hex nut, and is dimensionally interchangeable with the AN 364 shear nut.



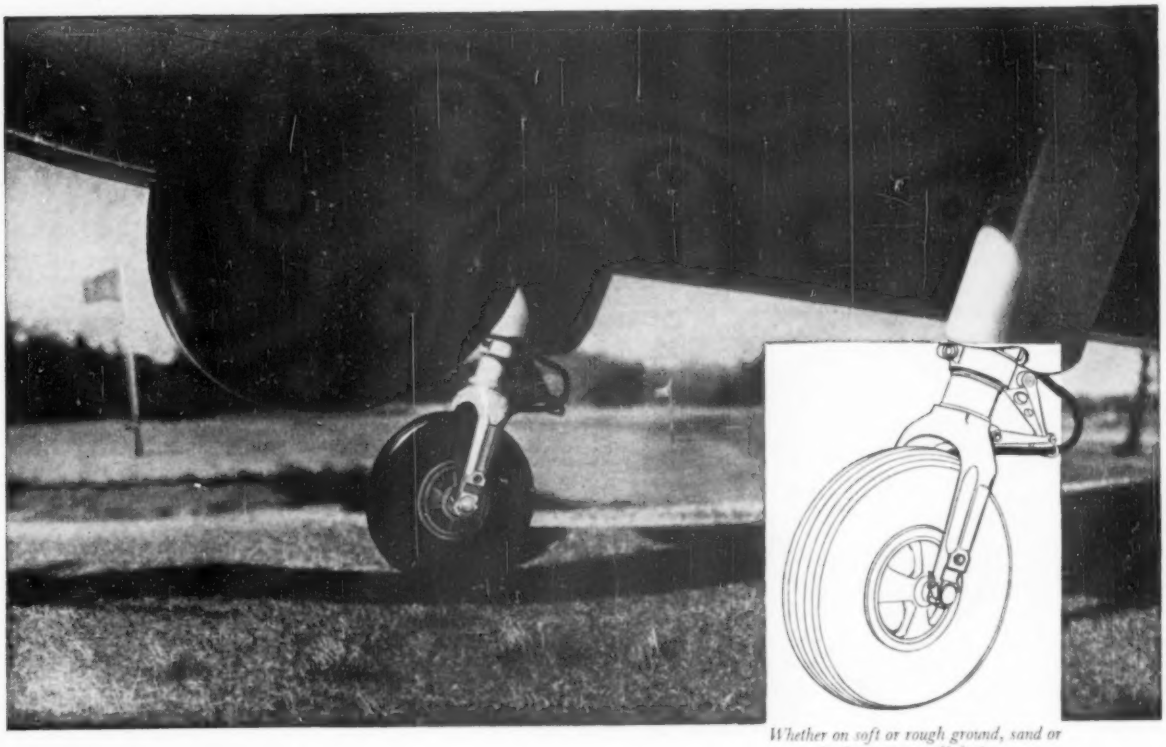
TOUGH THREADS extend Kaylock's life.

Kaynar says the nut will take temperatures of 550F, and the tempered threads are so hard they cannot be damaged by cross threading. The company reports that even after 200 installations and removals there is no appreciable loss of self-locking torque. Sizes available: 6-32, 8-32, 10-32, 4-28, 5/16-24, 3/8-24, 7/16-0.

Kaynar is located at 820 E. 16th St., Los Angeles.

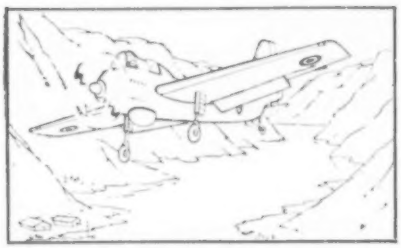
A new nut that may be used either as a locknut or as a threaded insert to replace stripped threads has been de-

Golf course fairway — *Seamew* runway



Whether on soft or rough ground, sand or grass, the Seamew can alight in an extremely small area because of its low landing speed and long oleo leg travel. Tyre sizes can be easily changed to suit terrain.

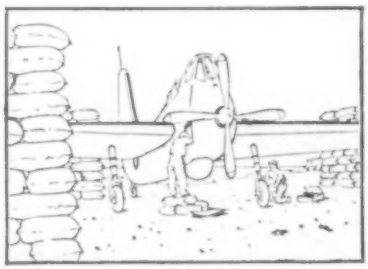
Seamew — a tough, economical, all-weather submarine hunter. In adverse weather — submarine weather — the Seamew can be airborne after a short take-off from an emergency strip . . . can conduct a radar search and low-level attack . . . and can land back safely almost anywhere (even on a golf course!) — due to its slow approach speed and shock-resisting undercarriage.



The extremely good handling characteristics of the Seamew combined with simplicity of construction and clear vision make it an excellent aircraft to fly, even for pilots with little experience of this type.

The *Short* answer is the *Seamew*

Economy of manufacture is paralleled by economy of maintenance, in terms of man-hours and spare components.



IN QUANTITY PRODUCTION FOR THE ROYAL NAVY

Short Brothers & Harland Ltd., Queens Island, Belfast, N. Ireland. The first manufacturers of aircraft in the world

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

Do you fit into this picture?

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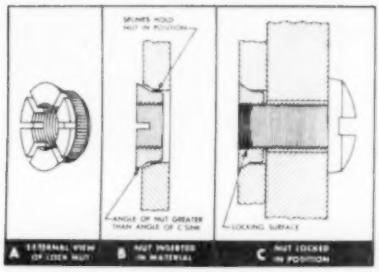


DUAL-DUTY is feature of Allmetal nut.

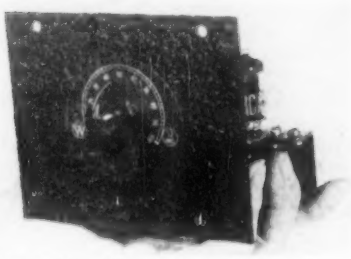
veloped by Allmetal Screw Products Co., Inc.

Consisting of a solid metal piece with a slotted cone shape on one end and a splined cylinder on the other, the nut is designed for insertion in a countersunk hole, effecting a flush mount.

The nut is partially or completely inserted in material, such as one of the softer metals, where it is held in position by force-fitted splines. When the bolt is inserted, locking action is obtained by the pressure of the sector threads forced against the bolt by interference of the countersinks.

The locking action is unaffected by high temperatures, and the nut remains in position and retains its locking action after the bolt is removed.

Allmetal's address: 821 Steward Ave., Garden City, L. I., N. Y.



FAST STARTING timer speeds output.

Electronic Interval Timer Needs No Warmup Period

New electronic interval timer uses filament-less cold-cathode tubes, so requires no time for warmup. Duration of the timing interval is continuously adjustable from 0.05 to 7 seconds.

The timer is suitable for push button, foot switch or other actuation of spot welders, heat sealers, punch presses, etc. It requires only 0.1 watt for operation from 105/125-volts, 25/400-cycle a.c. Timer is labeled Type 12 MC.

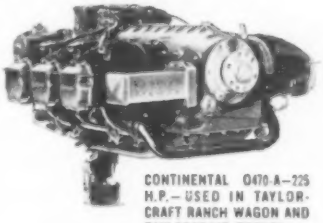
G. C. Wilson & Co., 1950 Eighth Ave., Huntington, W. Va.

New Sanding File Set Smoothes Welds and Burrs

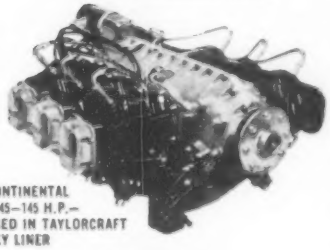
New sanding file set for cutting and smoothing welds, burrs and metal sur-

The NEW All-Fiberglas TAYLORCRAFTS

Fly with CONTINENTAL POWER



CONTINENTAL O470-A—225 H.P.—USED IN TAYLORCRAFT RANCH WAGON AND TAYLORCRAFT TOPPER



CONTINENTAL C145—145 H.P.—USED IN TAYLORCRAFT SKY LINER

Continental Motors shares Taylorcraft's pride of achievement in the three new series of utility planes currently being introduced by this industry pioneer. Like most other leading makes of airplanes, Taylorcraft's new all-Fiberglas models—the Ranch Wagon, the Sky Liner, and the Topper—offer the proven safety, dependability and economy of Continental power. The fact that 50 per cent of Taylorcraft's 1955 production is destined for export provides an additional reason for standardizing on Continental power. For Continental aircraft engines are backed by established service facilities . . . trained mechanics and genuine Continental parts . . . all over the world, wherever people fly.

MEN WHO LOOK TO THE FUTURE LOOK TO THE AIR FORCE RESERVE

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

faces has triple-coated diamond-hard abrasives on chip board tubes.

The tubes come in 10-in. length, and either 1-in. round or square end, to slip on a 14½-in. handle. Tubes of various grit sizes are interchangeable on the handle and are locked in place by means of a screw wedge in the slotted wood.

Abrasives are fuse-bonded on tubes, making possible washing out of metal filings without harming abrasive surface, maker states. Standard grit sizes are 36 (coarse), 60 (medium), and 120 (fine). Other sizes are available.

Diamilite Mfg. Co., 2301 Main St., Santa Monica, Calif.

ALSO ON THE MARKET

Ring-locked inserts and studs, with self-tapping thread to prevent collapse of inserts' tapping segments during installation, are now available.—Rosan, Inc., 2901 West Coast Highway, Newport Beach, Calif.

Two-element airport lamp gives warning when replacement is required. Bulb contains a 50-watt filament with life of 5,000 hr., and 25-watt filament with a design life of 8,000 hr. When the 50-watt element fails, the longer-life 25-watt element continues to burn, providing illumination but telling, by its dimness, that a new bulb is needed.—Solar Electric Corp., Warren, Pa.

Metal-backed nylon bearings allow rapid dissipation of heat, yet resist plastic deformation, permitting higher unit loading than other nylon bearings can take. Tolerances are held as close as .0002 in. on bore, length, outside diameter and concentricity. Sizes range from ½ in. up, in several types.—Nylacore Corp., Great Neck, N. Y.

Masking costs are cut with die-cut pressure-sensitive tapes that are precision-cut to the exact shape required by each masking job. Die-cut masks come on rolls and are mounted on quick release paper.—Printed Cellophane Tape Co., 521 No. La Brea Ave., Los Angeles 36.

Miniature vibration mounts, made entirely of metal, meet performance requirements of standard military specs for mounting airborne gear. The Series M24 mounts are attachable directly to equipment, saving weight and space. They can also be incorporated on mounting base or used internally. Mounts contain stainless steel load-carrying spring and formed wire mesh snubber to cushion shocks large enough to bottom the spring. Mounts come in ¼"-in. and 1-in. sizes.—Barry Corp., 32 E. 68 St., New York 21, N. Y.

B·H

fabricators for the aircraft industry

B. H. AIRCRAFT CO. INC.

FARMINGDALE, NEW YORK

FLETCHER

has the most experienced wing tank engineers in the U. S. A.

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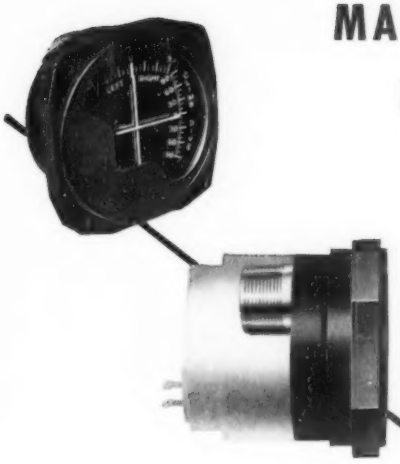
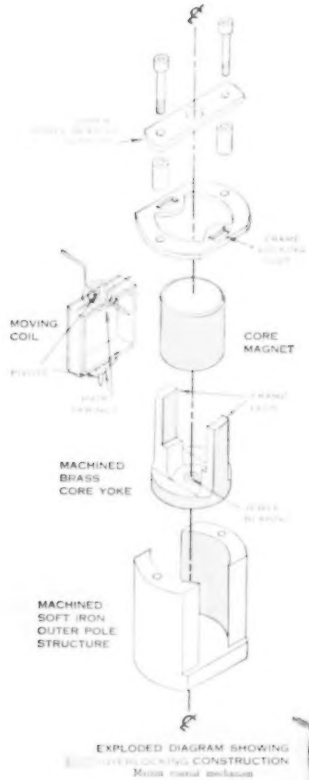
MARION COAXIAL* MECHANISMS MAKE NEW AIRCRAFT INSTRUMENTS LIGHTER, SMALLER, MORE STABLE



marion
advancement in instrument design



EXPLODED DIAGRAM SHOWING INTERLOCKING CONSTRUCTION

A new AN type multi-element aircraft instrument, incorporating recently developed Marion Coaxial Mechanisms, has greater durability and performance stability than many existing instruments of much greater size and weight. Applications of the new instrument, available with two, three or four elements, include ammeters, voltmeters, temperature indicators and radio navigational instruments. They meet the requirements of Army-Navy Aeronautical Design Standard AND10401 for 2¾" dial instruments.

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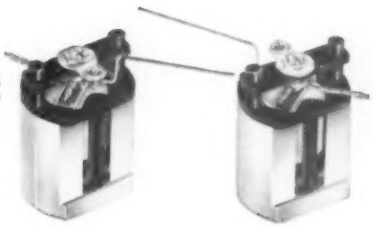

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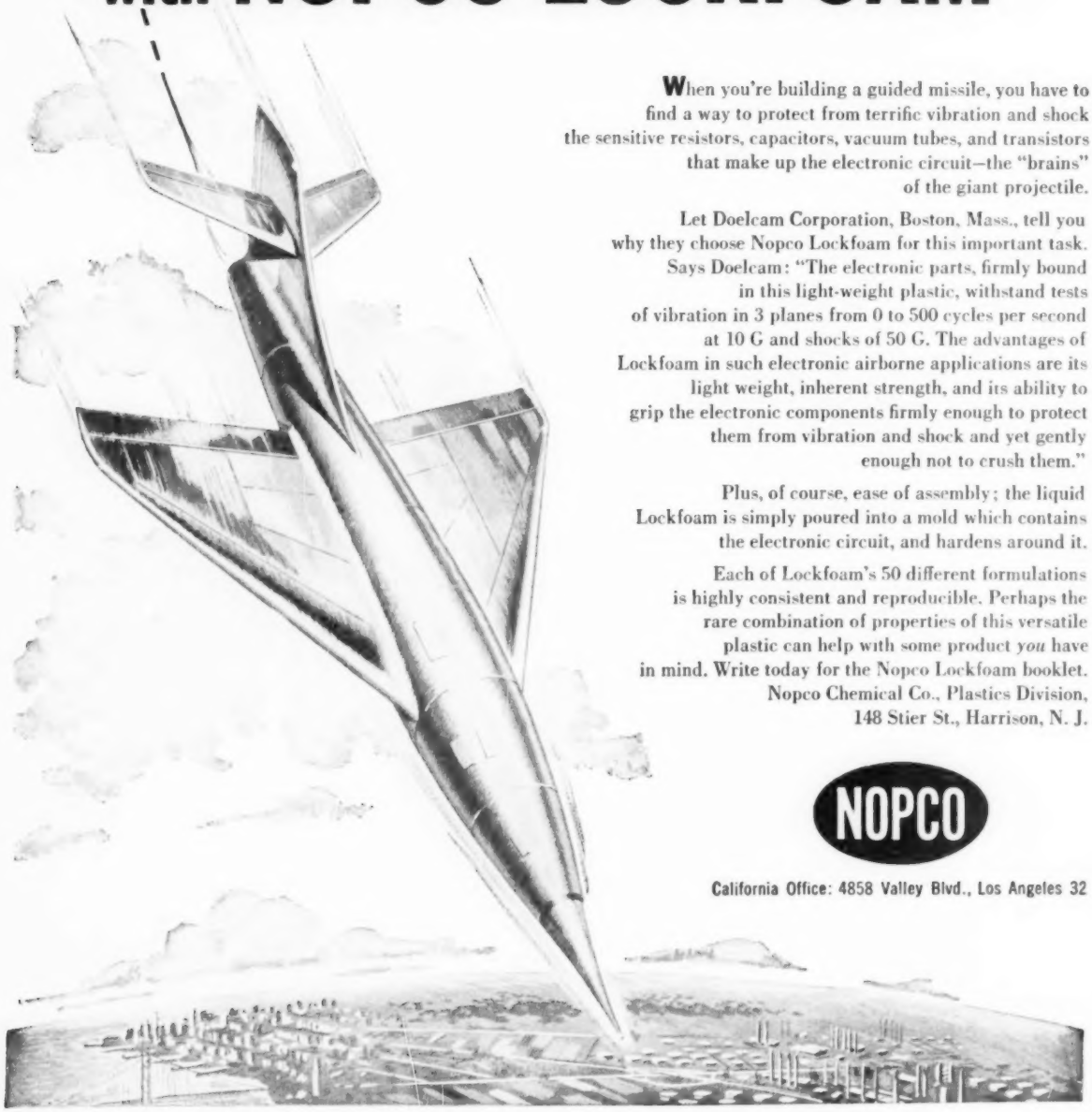

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Airfreight Forwarders Win Firm Support

- **CAB examiner says they are in public interest, urges Board to issue more affirmative operating authority.**
- **Most important factor in their survival is acceptance of their services by the shipping public, Pfeiffer finds.**

By Craig Lewis

Airfreight forwarders will find their position considerably strengthened if recommendations of Civil Aeronautics Board examiner Paul N. Pfeiffer in the airfreight forwarder investigation are adopted by CAB.

Pfeiffer found the industry to be much in the public interest, asked that forwarders get a new, more affirmative type of operating authority and recommended that existing operating authority be extended for an indefinite period.

The examiner's voluminous report caps a long and involved investigation designed to produce a permanent policy for regulation of indirect air carriers—airfreight forwarders. Regulations governing the new industry were set up in 1948 for a five-year period. They were due to expire in October 1953. CAB instituted the investigation in February 1953 to determine future action.

▶ **Airfreight Gains**—Pfeiffer says forwarders should be allowed to continue in business as licensees under CAB regulation despite the fact that some have made a poor financial showing, some have abandoned their operations and others never have operated.

"The most important factor," he says, "is the acceptance of forwarders' services by the shipping public in the amount of almost 30,000 tons in 1953 and the additional fact that this represents an increase over previous years.

"A considerable portion of this tonnage has moved at lower rates than those charged by the airlines. Such rates are in the public interest since they stimulate commerce generally and airfreight transportation in particular and thereby directly benefit the airlines."

▶ **Stimulates Progress**—Pfeiffer concludes that "the continuation of the airfreight forwarding function is in the public interest. The low rates, efficient ground handling service and extensive personal solicitation and advertising represent important instruments lending encouragement and stimulating the development of an air transportation system properly adapted to the present and future needs of the domestic commerce of the United States."

On the question of renewal of existing authority, Pfeiffer finds that inconclusive first results thus far are not grounds for limiting authority. Since no government subsidy is involved and the public utility of the industry's services is established, continuation is recommended.

Conferral of permanent authority might raise future legal complications so the soundest course, in the examiner's view, is to grant an indefinite renewal.

▶ **Prestige Factor**—The current letter of registration, a forwarder's operating authority, is found to be negative in character, and a more affirmative form is suggested with the view that it would lend prestige to the industry and give it a psychological lift.

Airfreight forwarding in the Hawaiian Islands is in the public interest, Pfeiffer says, and provision should be made for it in the revised regulations.

Air forwarders with affiliations with surface forwarders or motor carriers would have their authority renewed indefinitely. Some fears are expressed that air forwarders with railroad connections might dominate the field, but Pfeiffer believes CAB control is sufficient. He recommends that railroad-affiliated forwarders have their authority extended for five years as a reasonable trial period.

Other examiner recommendations:

- **Air Cargo's** application for an air forwarder authorization should be denied. Air Cargo is owned by 23 scheduled airlines, with United, Trans World, Eastern and American holding the bulk of the stock. The report recommends denial because of possible restraint of competition.
- **Fitness and public need** requirements are not necessary. Such rules would place an unnecessary burden on an expanding industry. Also, the type of industry involved is not one that calls for safety provisions to protect the public interest.
- **Several unapproved** interlocking relationships that came to light during hearings on the case are referred to the Bureau of Air Operations for action.
- **Railway Express Agency's** status should remain the same, but its Air Express Division classified as a forwarder.
- **Cooperative Shippers' Associations** should be granted indirect air carrier authority. The report suggests a form of report that should be required of such forwarders. Action on one association application is deferred until certain questions of control are clarified.
- **Authorization of joint rates,** fares and charges or compensation is recommended for services between indirect air carriers and airlines.
- **Airfreight forwarders** who also act as shippers' agents and/or airline agents should be required to advertise the fact.
- **Joint load agreements** should be authorized, but space allocation agreements between carriers would continue to be prohibited.
- **Insurance regulations** for indirect air carriers should be amended to require a minimum of $10,000 cargo liability coverage in any one conveyance and $5,000 public liability-property damage coverage for any one accident.
- **Air forwarders** should be permitted to charter airplanes from both certificated and irregular airlines.
- **The seven-day limit** on payment of freight charges to airlines by forwarders should remain the same.

Pfeiffer's findings become final unless exceptions are filed before Dec. 22.

60 Viscounts

Capital Airlines has picked up its option on an additional 20 Vickers Viscounts, bringing its total purchase of the turboprop-powered British airliners to 60 (Aviation Week Aug. 23, p. 55). Cost of the 60 transports: $67 million.

The new purchase increased the total Viscounts ordered to 177, plus options on an additional nine.

Scheduled Capital service with the Viscount is planned for April, when three of the aircraft are to be delivered. Delivery of the first order of 40 is scheduled to be completed by August 1956. The final 20 will be delivered by February 1957.

Capital will train crews for operation of the initial three Viscounts with Trans-Canada Air Lines (see p. 25).

The present Capital fleet of 58 planes is composed of 21 DC-3s, 25 DC-4s and 12 Constellations. These will be replaced gradually as the Viscounts are delivered until Capital has an all-turboprop operation.

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Merger Gets Nod

- **Board approves CAL purchase of Pioneer.**
- **But trunk-feeder ruling raises strong dissent.**

The long-pending Continental-Pioneer Air Lines merger proposal has been approved by the Civil Aeronautics Board in a 3-to-2 decision that sanctions the first consolidation of a trunk carrier with a local service airline.

The Board adopted the findings of examiner Thomas Wrenn (AVIATION WEEK July 26, p. 76) and the lineup of members followed the usual pattern, with chairman Chan Gurney and Oswald Ryan and Harmar Denny concurring and Josh Lee and Joseph Adams filing dissents.

▶**Policy Exception**—The majority says some airlines fear approval of the merger will start the Board on a course that will lead to the elimination of the local service airlines.

"No such conclusion should be drawn from our decision herein," the three-member bloc says. "The Board's general policy favoring separation of the local service carriers and trunklines will continue as a major guidepost in the Board's decisions."

The majority opinion describes the acquisition approval as an exception to CAB policy rather than an abandonment of it. The exception involved is the "usual and perhaps unique" degree of similarity between Continental and Pioneer that makes their difference of classification much less marked than with other trunk and local service airlines.

The decision finds the policy exception involved ". . . rests on deep-seated resemblances significant and strong enough to override nominal differences in classification."

▶**Labor Provisions**—Continental's purchase of Pioneer assets is subject to certain labor protective provisions specified by examiner Wrenn in his recommendations.

It also is subject to the provision that any amount paid PAL over the value of Pioneer's assets will not be recognized for Continental rate-making purposes.

According to the terms of the acquisition agreement, Continental will pay Pioneer its net book value in cash plus 65,000 shares of CAL stock valued at $6 a share. The total amount involved will be about $1.3 million.

Continental will attempt to close the deal as soon as possible—perhaps by the first of the year.

▶**'No Improvement'**—Minority member Lee based his dissent on three points. He believes the merger is inconsistent with the public interest because:

- "It violates the long-established Board policy of keeping the trunks and the feeders separate.
- "It provides practically no improvement of service to the public.
- "It slows Continental's progress toward becoming a subsidy-free trunkline carrier.

"The majority decision constitutes a further implementation of the policy of abolishing feeder carriers, a policy which this same majority of three supported in the Air Coordinating Committee report," says Lee.

Adams says he dissents because the majority opinion "derogates this Board's own local air carrier policy statement issued just three years ago and reaffirmed many times since its original adoption."

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Competitor Challenges Avianca in Colombia

(McGraw-Hill World News)

Bogota, Colombia—Avianca's virtual airline monopoly will be challenged next year when the newly organized Lloyd Aereo Colombiano starts service

on some of this country's most important routes.

The new airline expects to start service next month with new twin-engine Cessna 310 four-passenger planes, cruising at 220 mph. on these routes: Bogota-Cali, Bogota-Medellin, Bogota-Manizales.

On the line's longer domestic flights to the Atlantic coastal cities of Barranquilla and Cartagena, Lloyd Aereo plans to use 21-passenger DC-3s powered by Pratt & Whitney Aircraft R2000 engines.

In March or April the new airline plans to purchase Douglas DC-6s for services to the U.S. and possibly Europe.

Northwest Asks Tie With Copter Service

Passengers arriving in the New York metropolitan area will be able to connect by helicopter with Northwest Orient Airlines planes at New York's International Airport at no extra charge under an agreement worked out by the carrier and New York Airways, subject to approval by the Civil Aeronautics Board.

NWA and the scheduled helicopter service will absorb the rotary-wing shuttle charges, with the former taking the larger portion of the usual fare. Normally, NYA's charge for a flight from Newark (N. J.) Airport to NWA's terminal point, International Airport, runs $9.50. The arrangement and tariffs for the new service have been filed with CAB.

If granted, the integrated service will go into effect Jan. 5.

In addition, passengers arriving at International via NWA will be able to transfer to New York Airways' S-55 to go to White Plains, N. Y., or points in Connecticut and New Jersey, paying the normal fares for these shorthaul copter flights.

Plane Swap Deal

Pan American World Airways has entered into aircraft swap agreements with National and Eastern Air Lines that will enable all three carriers to have extra planes on hand during their peak traffic seasons.

Under terms of each agreement, PAA will lease two planes from National and two from Eastern for use from May to October—its peak European travel season. In turn, both NAL and EAL will lease two planes each from Pan American from December through May, peak period for their New York-Florida traffic.

All planes will carry the leasing airline's markings while in use by that carrier.

Airspace Policy Review

Review of federal policies on the use of navigable airspace has been started by the Air Coordinating Committee.

"No aviation problem is more important than the matter of our diminishing airspace," Commerce Undersecretary Robert Murray told a conference of regional airspace subcommittee secretaries, held in conjunction with the Washington subcommittee. Murray also is chairman of ACC.

The undersecretary said the ACC's civil air policy sets federal responsibility in relation to airspace control. "The Federal Government should continue, as it now does, to exercise exclusive control of the airspace over the United States, its territories and possessions for the purpose of controlling, preserving and protecting air navigation in the broadest sense," he said.

Murray noted the rapidly increasing demands being made on navigable airspace in the United States and observed that new airspace can not be created as can other resources. He asked the ACC to "establish such policies as will allow for the most equitable and economic utilization of this diminishing aviation resource."

The study will cover three phases: a survey of airspace problems and trends, development of a longrange policy and consideration of immediate steps that may be warranted.

". . . Full cognizance should be given to the needs of both civil and military requirements. Particular attention should be paid to the possible methods of joint use of some airspace areas now in exclusive use by a single agency or bureau. New traffic control techniques under development will be included in airspace policy planning," Murray said.

At the same time, Civil Aeronautics Administration changed the terminology describing airspace restricted areas. The term "danger area" was replaced by "restricted area" and "airspace restricted area" by "prohibited area."

CAA to Revamp New York Traffic

By Frank Shea, Jr.

Civil Aeronautics Administration, spurred by pleas of New York's Air Route Traffic Control Center officials and consequences of the now historic five-day IFR bottleneck over the metropolitan area Sept. 15-19, has gone into action to try to solve that city's critical air traffic problem.

CAA's emergency program, outlined by Administrator Fred B. Lee at a New York luncheon last week, includes:

- **Authorization** for recruitment and training of 38 additional controllers.
- **Installation** of an interim longrange surveillance radar at Mitchel AFB with coverage over a 100-mi. radius in cooperation with the Air Force. Schedule calls for operation by early spring of next year.
- **Establishment** of a permanent longrange radar at Idlewild International Airport as part of the new traffic control center now under construction. It is scheduled for completion the latter part of next year.
- **Temporary placement** of all New York ARTC controllers on a 48-hr. work week, pending hiring of the additional personnel.
- **Installation** of additional flight progress boards, improved interphone equipment, and six more channels for direct communication by the center with pilots in peripheral areas.

IFR traffic density has been slowly strangling air operations in the New York area over the past several years. Traffic has maintained a steady upswing, while control facilities and manpower have remained virtually static.

▶ **'Five Black Days'**—CAA has been studying the problem several years. But according to one New York official, "it took five black days with ARTC forced to handle 7,900 to 8,400 fix postings to make CAA throw the switch on an emergency program."

(With its staff at that time, New York's ARTC was equipped to handle approximately 7,000 fix postings during IFR conditions, four to five per aircraft handled or 1,700 aircraft per 24-hr. period. This is normally broken down as 3,000 from 8 a.m. to 4 p.m., 3,000 during the second 8-hr. shift and 1,000 from midnight to 8 a.m.)

CAA's New York program is a direct result of extensive studies made at the agency's Technical Development and Evaluation Center at Indianapolis. Big factor in these studies was the employment of an unusual device known as the dynamic air traffic control simulator, a joint project of the Air Navigation Development Board and CAA.

▶ **Other Areas, Too**—For many months mixed traffic problems taken from the New York area were fed into this simulator, testing and evaluating various combinations of systems, methods and control procedures. In addition to regular Evaluation Center personnel, representatives from New York's ARTC, the towers at LaGuardia, Newark, Idlewild

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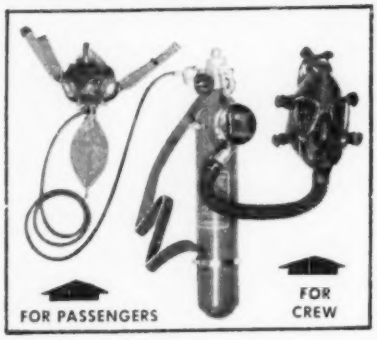

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and Teterboro participated in controlling traffic for all tests.

Although its problem is the most acute, New York is not alone in needing attention, Lee emphasized. He pointed out that similar studies are being made for Washington, Chicago, Norfolk and Dallas-Ft. Worth, as well as for other high-density traffic areas.

Citing the tremendous air traffic growth in the past several years, Lee said that within two years the number of fix postings handled by CAA's Air Route Traffic Control centers has increased almost 24%. In fiscal 1952, centers handled approximately 12.6 million fix postings. In fiscal 1954, the figure jumped to 15.6 million.

"We predict that the total for 1960 will be 24 million, or almost double the 1952 level," he said.

▶ **'Cocoon of Air'**—Turning from terminal area problems, Lee reported that CAA now is proceeding to attack the enroute phase of the airspace situation. "In all problem routes," he asserted, "we find one common factor: If airspace is shrinking, it is because present equipment makes such extravagant use of it."

It now is necessary to wrap aircraft in a large "cocoon of air" because neither pilot nor controller can pinpoint the plane's position with sufficient accuracy to allow a narrower margin of safety, and because the CAA center which controls enroute traffic does not have direct communications with pilots much beyond the terminal area, he added.

"Obviously, this problem will be compounded when jets with twice the speed of present aircraft begin flying our airways. Fortunately, we have anticipated the need, and over the past few years have developed means for meeting it."

Lee then cited these improvements:

• "Omniranges already are well established on the ground and in the air to tell us exactly what course heading we are on. To know exactly how far along the course heading we are, we must supplement the omnirange with distance measuring equipment."

• "CAA has commissioned 230 DME ground transmitters, covering all the most heavily traveled routes. When a substantial number of aircraft operators install DME airborne equipment, major advances in traffic handling will become possible."

▶ **Position Report**—Under such a system both pilot and controller will have exact, instantaneous information on aircraft location at all times, Lee said. Result would be that the controller could safely assign a more reasonably-sized block of airspace, possibly 5 mi. long instead of 30, he noted. "Traffic snarls due to lost aircraft can be elim-

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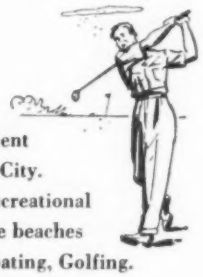

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inated, and when holding is required, it can be accomplished with less use of airspace."

Lee also pointed out that with precise position reports from the pilot, immediate identification of individual aircraft can be made on the radar, thus increasing its usefulness in traffic control.

"We shall, of course, need more radar route coverage, similar to what is now underway at New York, and an extension of direct communications via peripheral slave stations" (AVIATION WEEK Jan. 26, 1953, p. 38). He noted that peripheral sites now enable the New York center to talk directly with pilots near Wilkes-Barre, 100 mi. out, and stated that other facilities being installed will extend the center's range to as much as 225 mi.

▶ **Favors DME**—More radar and direct communications will require additional expenditure of government money, "which I am in no position to promise," he said.

In support of DME, Lee pointed out that all it takes to reap the benefits of this system right now is for aircraft operators to install the equipment on their planes. He noted that operators who have already done so are very pleased.

To those operators who have been hesitating, he warned: "DME is the only system that is in and ready to go, and it will be the only distance indication system available for general use for some years.

"DME, longrange radar, direct communications; these are some of our prospectives for the immediate future, subject, of course, to availability of funds. We know, of course, that we must keep working on additional improvements to stay abreast of increasing traffic and speed.

"In close cooperation with the Air Navigation Development Board, where we are partners with the military, we have many ideas moving along the sometimes long road from inspiration to application."

As examples, Lee cited large, bright cathode ray radar displays for use in control centers and airport towers; radar for airport surface traffic control; radar air traffic control beacons; magnetic drum storage equipment, and limited data transfer.

Houston Opens New $5-Million Terminal

Somewhat removed from the heated battlefield of the Dallas-Ft. Worth airport controversy (AVIATION WEEK Nov. 29, p. 77), Texans in the city of Houston quietly have opened a new $5-million International Air Terminal.

Located 10 mi. southeast of downtown Houston, the new installation has approximately 100,000 sq. ft. of usable floor space for airline ticket counters and other facilities, offices and concessions.

Chief attraction of the terminal is a unique arrangement of two double fingers extending from the field side of the building, equipped with escalators for channeling passengers to and from the 16-plane landing stations.

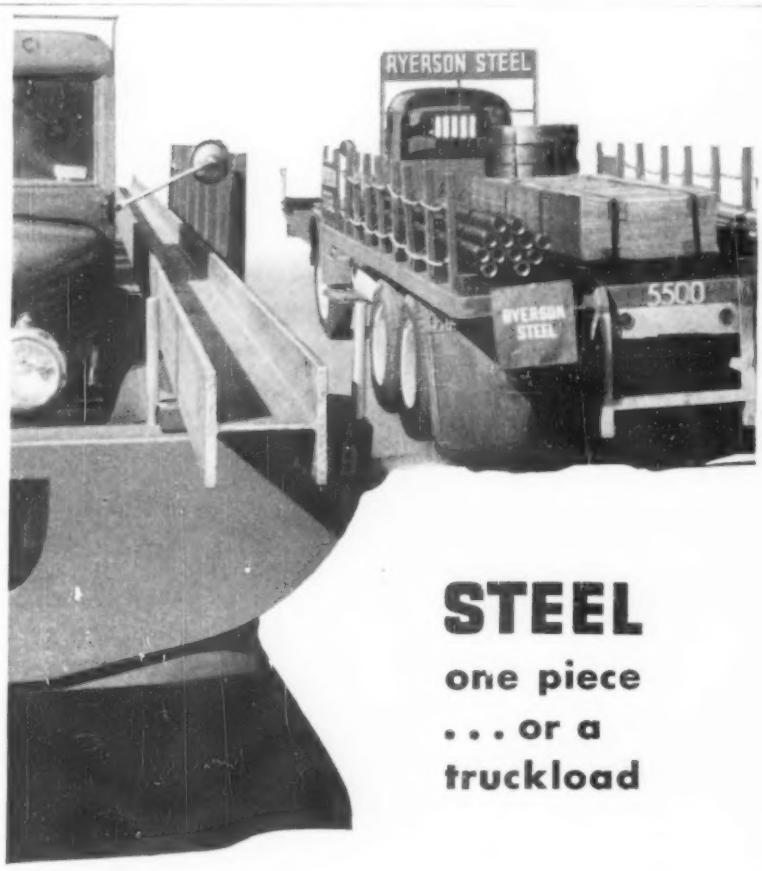
The terminal also has a 13-room hotel on the first floor of the building for passengers staying overnight or wanting to rest between flights.

The waiting room has a capacity for more than 300 persons, with two dining rooms and a snack bar located nearby.

EAL Pushes Evidence Fight in Mexico Case

Eastern Air Lines is pushing its fight for subpoenas designed to produce added evidence in support of its case in the New York-Mexico City nonstop case. EAL has appealed a decision by Civil Aeronautics Board examiner Edward T. Stodola denying the subpoenas (AVIATION WEEK Dec. 6, p. 112).

The airline had asked CAB to subpoena a number of government officials and various documents in support of numerous contentions made in the hearings on the New York-Mexico City



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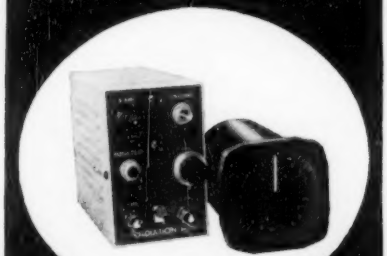

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case. The examiner turned the request down on the grounds that such information is "privileged."

▶**All the Facts**—Eastern claims the President decides cases of this nature on a record compiled through the Board's hearing process and says "all of the facts and circumstances must be included in this record in order that the President may decide the case properly."

As for Stodola's ruling on the application for subpoenas, Eastern says he is wrong because:

- The information sought is not privileged.
- Even if, for the sake of argument, some items were privileged, each must be decided individually "in the light of its own facts and the claim of privilege."
- If some information were privileged against disclosure in a judicial proceeding, all of the information sought is subject to disclosure to the President and, therefore, before "a tribunal whose sole duty with respect to this proceeding is to assemble relevant information on the subject matter of the proceeding for the President."
- Common justice and equity and due process of law require that all pertinent facts be assembled for the President's consideration.

Alaska Wants Airline Routes Unchanged

Support for the present route structure in U.S.-Alaska air service came from Congress last week. E. L. Bartlett, delegate to Congress from Alaska, asked Civil Aeronautics Board to leave service unchanged in deciding the States-Alaska case (AVIATION WEEK Aug. 9, p. 48).

Bartlett's letter to CAB Chairman Chan Gurney followed an earlier communication expressing the hope that a decision in the States-Alaska case would result in "no lessening of service."

▶**Fundamental Change**—The Alaskan delegate said reports had reached him that the Board was contemplating a fundamental change in the present air pattern.

Specifically, he referred to speculation that Alaska Airlines would not be certificated to Fairbanks and Northwest Airlines would not be recertificated to Anchorage but would be routed through to the Orient via Cold Bay. Under this plan, Pan American World Airways would get the Seattle-Anchorage segment, and Pacific Northern would be recertificated from Portland/Seattle to Anchorage.

Bartlett is in favor of the Pacific Northern recertification, but opposed to the other moves.

▶**Dominant Position**—"Although I be-

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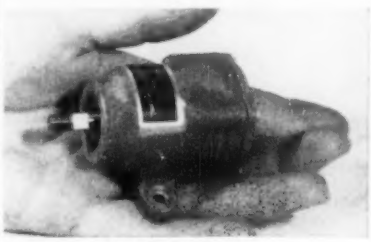

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lieve that Pan American has done a very creditable job in the performance of its Alaska service," said Bartlett, "its exclusive occupancy of the States-Fairbanks route and its replacement of Northwest between the States and Anchorage would give it a dominant position which no company should have.

"The pattern heretofore established provides competitive service to the main Alaska communities in interior and southwestern Alaska, and should be maintained. I firmly believe that this is to the advantage of the Federal Government as well as to Alaska, and I respectfully urge the Board to take affirmative action in maintaining the status quo," he said.

500,000th Passenger

Southern Airways carried its 500,000th passenger, Nov. 30 on a Columbus, Ga.-Washington, D. C., flight.

CAB ORDERS

(Nov. 25-Dec. 1)

GRANTED:

Flathead County Airport Board of Kalispell, Mont., leave to intervene in the application of Northwest Airlines for temporary suspension of service at Kalispell on Route 3.

Braniff Airways' application to suspend service at Austin-Albert Lea, Minn. A separate application to suspend service at Owatonna-Faribault-Waseca, Minn., is dismissed, since the authority for that service has expired.

Flying Tiger Line's application for an exemption to perform one passenger flight from Munich, Germany, to New York Dec. 7.

APPROVED:

Intercompany agreements involving Continental Air Lines, Trans-Texas Airways and the Texas Co. and various other carriers.

AMENDED:

Japan Air Lines' foreign air carrier permit to designate Naha, Okinawa, as an intermediate point and Hong Kong as a terminal point on segment 2.

ORDERED:

Military exemptions extended to Dec. 1, 1955, for certificated U. S. and Alaskan air carriers, certificated cargo carriers, and large irregular transport carriers.

Atlas Corp.-Convair control case terminated, since Atlas has transferred its interest in Convair to General Dynamics Corp. and the circumstances that warranted the proceeding no longer exist.

DENIED:

Braniff Airways' application for a temporary suspension of service at Laredo, Tex.

Aerovias "Q", S. A., application to operate between Key West and West Palm Beach, Fla.

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Hughes Field Engineer H. Heaton Barker (right) discusses operation of fire control system with Royal Canadian Air Force technicians. Avro Canada CF-100 shown at right.

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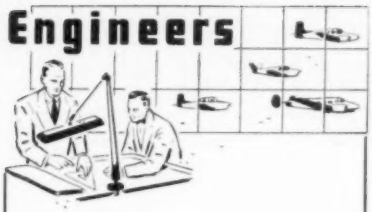

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News Sidelights

Curtiss-Wright has just now been permitted to reveal that it has developed "the first rocket engine in the U. S. that can be throttled up and down . . . and stopped at will," nearly three-and-a-half years after AVIATION WEEK reported that the Bell X-2 research plane would be fitted with a C-W rocket powerplant with these features (AVIATION WEEK July 9, 1951, p. 27).

Some British sources are telling Germans that Convair is halting civil production of its 340 because it is an "obsolete aircraft." This is part of a campaign to convince the new West German airline it should buy equipment from England, instead of the U. S., European observers say.

Max Conrad's next trans-Atlantic delivery of Piper Apache is planned for soon after Christmas. This time Conrad, who made international headlines with his nonstop New York-Paris delivery of an Apache last month, will go to Gander and then fly across to Paris. His third delivery flight will be to Spain, set for February.

A Russian made the first balloon flight in 1731, more than a half century before the Montgolfier brothers in France, according to an article by Prof. A. Pirvu in the Bucharest newspaper, Scientea.

First distributorships for a new Champion lightplane are settled in the East, Midwest, West and Canada. Builder, Champion Aircraft Corp., Holman Field, St. Paul 1, Minn., who purchased rights, tools, dies and jigs from Aeronca, has modified an experimental Champion that has clipped, metal-covered wings; 115-hp. Lycoming engine with controllable pitch prop and redesigned interior. First production model of the two-placer 7-EC was scheduled to roll out early this month, with one per week coming out starting in January and three weekly by July.

DIG THOSE CRAZY UNDIES—New Royal Air Force transparent nylon cooling suits, displayed by pilots of the first Canberra jet bomber unit to be based in Germany, reportedly caused a sensation when the men gave this impromptu fashion show on arrival. The new "undies" have a network of small-diameter tubing that plugs into a cooling duct in the Canberra cockpit. Tubing distributes cool air over the body to counteract excess heat in the plane when it is flown at low altitudes. Refrigerated vans are being distributed to squadrons so crewmen can avoid catching colds from rapid temperature changes. Crews are transported directly from planes to changing rooms where body temperature is lowered gradually in showerbaths.

AVIATION CALENDAR

Dec. 16—Air Force Assn., air logistics conference, Andrews AFB, Camp Springs, Md.

Dec. 17—Wright Day Dinner, Statler Hotel, Washington, D. C.

Dec. 17—Institute of the Aeronautical Sciences, 18th Wright Brothers Lecture, U. S. Chamber of Commerce Building, Washington, D. C.; to be repeated Dec. 20 in Los Angeles and Dec. 22 in Cleveland. Lecturer: Bo Lundberg, director of Sweden's Aeronautical Research Institute.

Dec. 28-29—National Science Foundation, fourth Conference on Scientific Manpower, Berkeley, Calif.

Jan. 10-14—Society of Automotive Engineers, annual meeting and engineering display, Sheraton-Cadillac and Hotel Statler, Detroit.

Jan. 19-23—Miami International Aerorama, Miami (Fla.) International Airport.

Jan. 24-27—American Meteorological Society, 135th national meeting, New York.

Jan. 24-27—Plant Maintenance & Engineering Show and three-day conference, International Amphitheatre, Chicago.

Jan. 24-28—Institute of the Aeronautical Sciences, 23rd annual meeting Honors Night Dinner, Hotel Astor, New York.

Jan. 27-28—Southern California Meter Assn., fourth annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif.

Jan. 31-Feb. 4—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York.

Feb. 8-10—Society of the Plastics Industry, 10th Reinforced Plastics Division Conference, Hotel Statler, Los Angeles.

Feb. 10-11—Society of American Military Engineers, military-industrial conference on manpower, Conrad-Hilton, Chicago.

Feb. 20-22—Fourth annual Texas Agricultural Aviation Conference, A&M College of Texas, College Station, Tex.

Mar. 11—Institute of the Aeronautical Sciences, National Flight Propulsion Meeting (restricted), Hotel Carter, Cleveland.

Mar. 14-16—Society of Automotive Engineers, production meeting and forum, Netherland Plaza, Cincinnati.

Mar. 14-17—American Society of Tool Engineers, 1955 annual meeting, Shrine Auditorium, Exposition Hall, Los Angeles.

Mar. 21-24—Institute of Radio Engineers, national conference, Waldorf-Astoria Hotel and Kingsbridge Armory, New York.

Mar. 28-Apr. 1—American Society for Metals, ninth Western Metal Exposition and Congress, to include the American Welding Society's technical session on aircraft and rocketry, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Mar. 31-Apr. 1—Symposium on Boundary Layer Effects in Aerodynamics, Britain's National Physical Laboratory, Teddington, England.

Apr. 18-21—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, Hotel Statler and McAlpin Hotel, New York.

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LETTERS

Jet Airworthiness

In Washington Roundup (Nov. 8, 1954) you comment that evidence at the Comet inquiry in London is confirming the Civil Aeronautics Administration attitude that the British Air Registration Board did not require sufficiently stringent tests for airworthiness certification.

As the findings of the court are not yet known, it would be improper to make any observations regarding the cause of the accidents or the steps to take to avoid repetition. It is, however, desirable to draw attention to one or two matters of fact.

The inquiry has centered around fatigue failure of pressure cabins. Consider first the printed requirements of our two countries, both the American CAR 4b and the British Civil Airworthiness Requirements concentrate on static strength (the two sets of requirements being virtually identical), and neither deals explicitly with strength under repeated pressurization loads. The practice in the United Kingdom is, however, in advance of the printed requirements. A representative portion (some 28 feet in length) of the Comet pressure cabin was tested before certification to 2,000 applications of working pressure, and later a further 16,000 applications of working pressure were applied—equivalent to a total of 18,000 flights. Similar tests have been made on other pressurized British aircraft.

American practice is not known to the Board, but an indication of the CAA thinking is given in the CAA's proposed policies for airworthiness certification of turbine transports. The 1953 issue of this document proposes that typical window emergency exit and door installations should be capable of withstanding repeated loading of at least 10,000 applications of maximum differential pressure. In the 1954 document, it is said that manufacturers expressed doubts as to the adequacy of these steps and that the general view seemed to be that all parts of the cabin would need to be tested. It was concluded by CAA that the matter needed further study in order to arrive at a suitable policy.

The trend of British thinking is shown in a draft requirement of the Air Registration Board dated June 1953, which proposes that a representative pressure cabin should be subjected to 15,000 applications of 125% of working pressure.

It is, of course, possible that, as a result of experience with the Comet, more extensive or more prolonged tests will appear necessary. It would not, however, be correct to infer that British requirements or practice have lagged behind those of the United States of America.

R. E. Hardingham
Chief Executive
Air Registration Board
Brettenham House
Strand, London, W. C. 2

Praise

Your Nov. 5 issue of Aviation Week carried an article by Robert Hotz entitled, "The New U.S. Air Force—Roger Lewis Outlines Policy." Assistant Secretary Lewis would appreciate receiving 10 copies of this article for official purposes.

Joseph G. Nott
Chief, Administrative Services Division
Office, Administrative Assistant to the
Secretary of the Air Force

(Aviation Week's exclusive interview with Roger Lewis, Assistant USAF Secretary for Materiel, also was inserted in the Congressional Record of Dec. 2 by Sen. Roman Hruska of Nebraska.—Ed.)

No Supersonic Fish

Perhaps our aero engineers could learn something from nature.

In fishes, we have the tuna and the mackerel, both good examples of "fuselage" streamlining. Swordfish have better "needle-noses" than do our supersonic planes. All birds are highwing monoplanes, something that our engineers seem to be rediscovering.

Why can't we learn to integrate powerplants, accessories, fuel, etc., into the fuselage or wings. You don't see any birds flying around with pods or wing tip tanks. In other words airplanes should be streamlined to the Nth degree, which no airplane is today.

Leonard Wyrauch
4402 Locust Street
Philadelphia 4, Pa.

("Today's airplanes represent a high degree of streamlining and sophistication in design," says David Anderton, our engineering editor. "I honestly believe that to copy fish or birds would be taking one step backward. Birds and fish work fine in their element, but have you ever heard of a supersonic sparrow, or a Mach 1 mackerel?"

Decca Comments

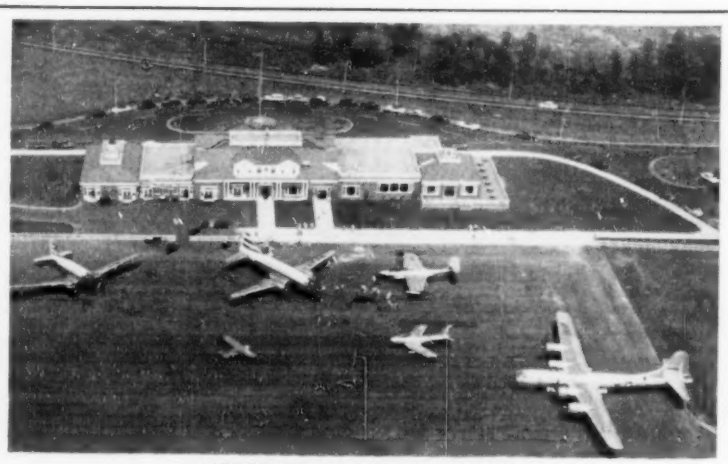
We were pleased to note your report Nov. 15, concerning acquisition by Bendix Pacific of United States sales and manufacturing rights to the Decca system of navigation.

The last paragraph of your article, I assume, refers to the Air Coordinating Committee report on Electronic Systems of Air Navigation published in March of 1954. If this assumption is correct, we would like to point out that this ACC report failed to take account of the anti-static antenna employed by Decca for aircraft installations. Use of this antenna coupled with narrow band pass techniques reduces the adverse effects of static upon the system to a level which is unimportant operationally.

Regarding the question of propagation disturbances, accuracy performance figures quoted for the Decca system include these effects. A study of these Decca performance figures, alongside those of other systems, will ably illustrate that the Decca system is not at a disadvantage in this regards.

Thomas D. Johnson
Vice President—Sales
The Decca Navigator System, Inc.
521-539 West 25th Street
New York 1, N. Y.

(Other Letters on p. 72)



WORCESTER MUNICIPAL AIRPORT

The cornerstone for the new Administration Building of Worcester Municipal Airport was laid on July 9, 1953, and sealed within was a copy of the Master Plan of the airport originally developed when the airport was started in 1946; a copy of the current issue of the Worcester Evening Gazette which included a news item in connection with the airport development; the current flight schedule of Northeast Airlines, and a copy of the July 6 issue of Aviation Week, representing a most complete picture of the aircraft industry of that date.

The Administration Building was completed this July but we postponed formal dedication until this fall. We really believe that we have facilities at our airport which are unique both in beauty and serviceability.

Robert W. Stoddard
Chairman, Airport Commission
Worcester Municipal Airport
Worcester, Mass.

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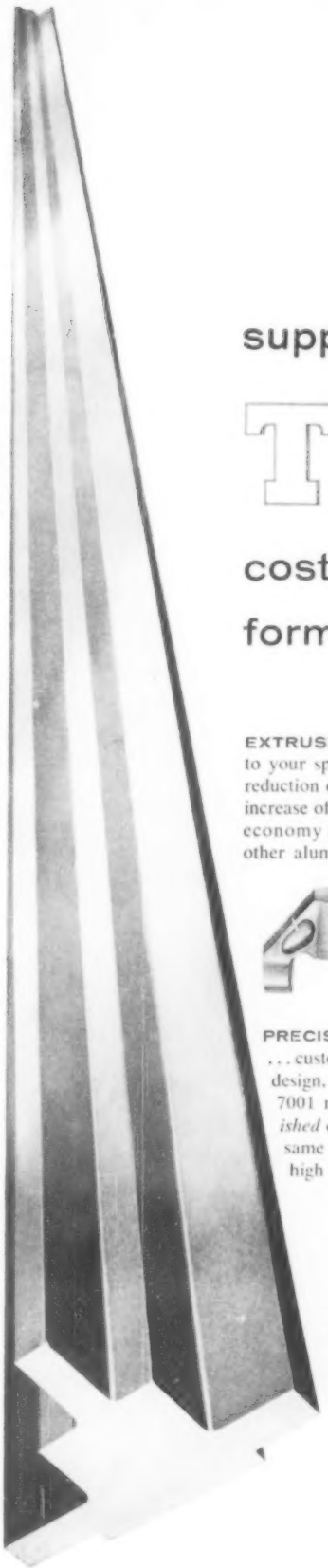

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